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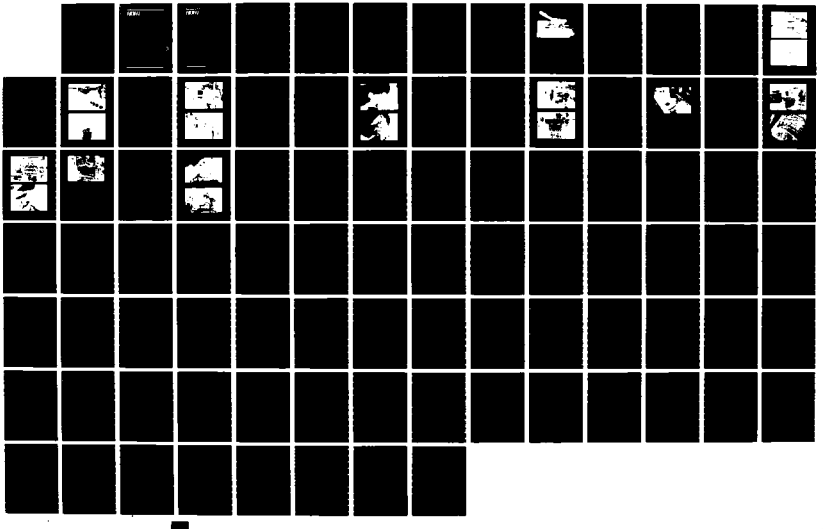

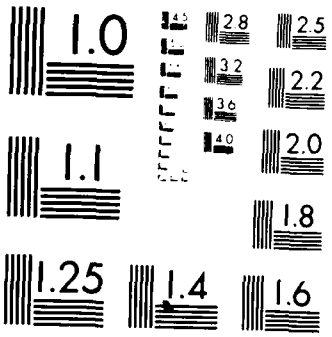

THE BDM CORPORATION

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Human Factors Engineering Data Base Development for Armored Combat Vehicles and Analyses of Three NATO Tank Systems

Volume III - Human Factors Engineering Analysis of the British Chieftain Main Battle Tank

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VOLUME III

HUMAN FACTORS ENGINEERING ANALYSIS OF THE BRITISH CHIEFTAIN MAIN BATTLE TANK

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CHAPTER I

HUMAN FACTORS ENGINEERING ANALYSIS OF THE BRITISH CHIEFTAIN MAIN BATTLE TANK

A. BRITISH CHIEFTAIN

1. Development

The British Army issued a requirement during the 1950s for the development of a new tank with improved firepower, armor, and mobility. The Chieftain was designed by the Fighting Vehicle Research and Development Establishment with the first prototype completed in 1959. The Chieftain prototype was followed by six further prototypes in 1961 and 1962 and was accepted for Army use in 1963. However, the Chieftain did not enter service with the British Army until 1967 because of design problems with the engine, transmission, and suspension.

Currently, the British Royal Armoured Corps has ten regiments equipped with the Chieftain, eight in the British Army of the Rhine and the remaining two located in the United Kingdom.

2. Description

The Chieftain MBT, shown in Figure I-1, was designed with the priority of firepower first, protection second, and mobility last. The hull of the Chieftain consists of cast sections welded together and divided into three basic compartments: driver's located at the front, firepower in the center, and the engine located to the rear.

The driver is provided with a single wide-angle periscope that can be replaced by an infrared periscope for night driving, which is being superseded by a passive night driving periscope developed by Pilkington PE Limited.

The turret section consists of a one-piece casting with the loader located on the left and the commander and gunner on the right. The commander's cupola can be traversed 360 degrees by hand and has a single-piece hatch cover with nine observation periscopes and a single sighting periscope. Located on the right side of the commander's cupola is an infrared searchlight that is mounted coaxially with the cupola-mounted machine gun.

Figure I-1. Chieftain MBT

The gunner is located in front of and below the commander's position and has a sight periscope or a Barr and Stroud Tank Laser Sight Unit. Both the gunner and commander can replace their day sights with a three power magnification infra-red sight.

The loader has a two-piece hatch and a folding rotatable periscope.

Attachment 2 contains the complete data file of information collected at Ft. Knox during the evaluation relative to the Chieftain's soldier-materiel interface.

B. HFEA OF THE CHIEFTAIN MBT

1. General, Boarding, Movement

Like the Centurion, the Chieftain lacks dedicated handholds and footholds, making boarding difficult. To board, the crew must use the

tracks as steps (tracks offer only three inches for a foothold) and grasp the available deck items, such as cables and headlights, when climbing aboard. This presents somewhat of a safety problem when attempting to do so quickly. Also, non-skid surfaces are not provided, making footing a hazard when working on deck.

The two-piece hatches for the commander and loader are easy to open and close, making ingress/egress easy. The driver's station is provided with a one-piece swing hatch which is also easy to operate. Generally, moving into and out of as well as moving within the vehicle were found to be very adequate. The turret must be rotated to allow the gunner to egress back and into the turret area. The space provided at the foot of the gunner's station for driver egress into the turret measured only 10.75 inches in height by 22.75 inches in width. This area would present difficulties for crewmen garbed in arctic or NBC MOPP gear. Dead weight drag from the driver's station into the turret would also be very difficult.

2. Driver's Station

Referring to Table I-1, only the seat dimensions for the driver appear adequate, according to MIL-STD-1472C. The driver's seat assumes a semi-reclined profile, much like the United States M1 Abrams MBT, to reduce the tank's profile. The Chieftain, however, uses laterals for steering, making driving difficult in a reclined posture. Seat depth, head clearance, and popliteal height fell short of design standards.

Although the seat adjustment control was difficult to access, seat adjustment was easy. The head rest was broken and could not be evaluated properly. In fact, the design of the head rest appeared unreliable to evaluators; that is, the support structure appeared vulnerable to failure. With a broken head rest, closed hatch operation would be all but impossible. The operator could no longer support his head to view through the single periscope provided for that purpose.

The periscope, which is located directly behind the hatch opening, is provided with browpads. The driver, when reclined, views the outside and controls the vehicle using the single periscope.

With the seat adjusted fully up, open hatch, some displays and controls were difficult to see. The accelerator pedal measured only

TABLE I-1. SELECTED MEASUREMENTS OF VEHICLE SEATING AND ANTHROPOMETRY

	Seat Pan Dimensions (Length x Width)	Seat Back	Seat Padding Thickness	Seat Depth	Boot Clearance	Head Clearance	Control Distance	Shoulder Clearance	Static Elbow	Popliteal Height
Criteria	(15-17) x 18 in	(18-20) x 18 in	(1.5 in.)	(16 in.)	(14 in.)	(39.5 in.)	(34 in.)	(19.6 in.)	(21.1 in.)	(19.7 in.)
Centurion										
Driver	*15.75 x 15.5	*14 x 16	1.5 - 3.0	*8.0	16.0	*34.0	24.5	*17.5	23.0	19.25
Cmdr	*10.25 x 14.5	*4.25 x 10	1.25	*5.0	13.5	*36.0	27.0	–	24.0	*18.0
Gunner	*13 x 13	4.25 x 10	2.75	*6.5	*9.5	39.0	21.0	21.0	*19.75	16 - 20.5
Loader	*13.5 x 13.75	*4.25 x 12	2.0	*7.0	*5.25	47.0	17.25	19.25	29.0	*24.0
Chieftain										
Driver	18.25 x 16.25	18.25 x 14.25	3.75	*14.0	14.5	*26.0	26.0	20.0	27.5	*11.0
Cmdr	14.25 x 15.0	*10.0 x 11.0	2.0	*9.5	*11.0	*38.25	28.75	20.0	26.0	12.0 - 22.0
Gunner	*12.0 x 14.5	*5.5 x 11.0	2.5	*8.0	15.5	39.0	16.0	21.0	26.0	18.0 - 22.0
Loader	–	–	–	–	–	–	–	–	–	–
AMX 13										
Driver	*10.5 x 14.0	*11 x 12.75	3.75	*6.25	23.25	*32.25	25.0	*14.75	22.5	*15.25
Cmdr	*9.75 dia.	–	1.0	–	–	–	–	–	–	–
Gunner	*9.5 x 10.75	–	1.5	*5.5	*7.5	*35.0	*15.0	*16.0	21.0	*23.0

*Failed to meet standards

86 0608 TR W 01

Footnotes to Table I-1:

1) .75 in. added for head clearance criteria to account for CVC helmet; 5 in. added for seat compassability
2) Figures for head clearance with seats adjusted fully down.
3) Figures for control distance are measurements from seat back to closest hand control forward.
4) Popliteal height includes ranges of height (vertical adjustability) for seats capable of adjustment.
5) Blank spaces indicate missing part or whole equipment items precluding measurements.
6) Asterisks indicate actual measurements which fail to meet MIL-STD-1472C criteria by >1.0 inch.

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References to Table I-1:

Seat Depth – Seat reference point to front edge of seat pan. MIL-STD-1472C, Table 59, Human Eng. Design Data Digest

Boot Clearance – Front of seat pan to heel point of accelerator. MIL-STD-1472C, Table 59

Head Clearance – SRP to roof line, Table 59

Control Distance – Functional Reach, Table 33.

Shoulder Clearance – Bideltoid breadth, Figure 27.

Static Elbow – Forearm-forearm breadth, Figure 27.

Popliteal height – Figure 26.

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2.75 inches and the brake pedal was only 13 inches from the front of the seat, making free leg movement difficult. Also, reflective glare on the instruments presented a problem (even with the relatively low light levels within the building).

The driver's area was cramped for a 95th percentile male occupant. Some items requiring maintenance access were extremely difficult to access. Some wire bundles were located as far as 50 inches in the left front hull area, making access almost impossible for all, even the smaller crewmen.

Most switch and dial controls appeared to be grouped logically and were readily accessible. Display luminance control also was provided. Switches are provided with safeguards to prevent accidental activation.

Two identical control boxes were positioned to the driver's front, with no clear indication of the purpose of the boxes, except for references to "generator-engine," and "start." It was not obvious why two control panels were provided.

The NBC collective protection consists of a ventilation box located to the left rear of the driver. The NBC collective protection provides overpressure and filtered air to each of the crew members. Each NBC junction box has two air ventilation ports which provide for directional flow, and an access point for the individual's NBC face mask hose. Access to the box is difficult.

The driver's hatch, as seen in Figure I-2, is provided with a one-piece swing hatch, which proved easy to operate. Hatch dimensions are 15 x 21.25 inches. The hatch was rated as adequate for ingress/egress of 95th percentile male crewmen, arctic garbed. The driver's station, when considering buttock-leg length (Table 29, MIL-HDBK 759A), accommodates less than the 5th percentile male (actual measurements are 18.25 [seat pan length] + 19 inches [distance to accelerator, depressed] equals 37.25 inches). This is approximately 2 inches short of the minimum length for a 5th percentile male.

Chances of driver injury from a traversing turret appeared highly unlikely. Closed hatch viewing through the periscopic system was

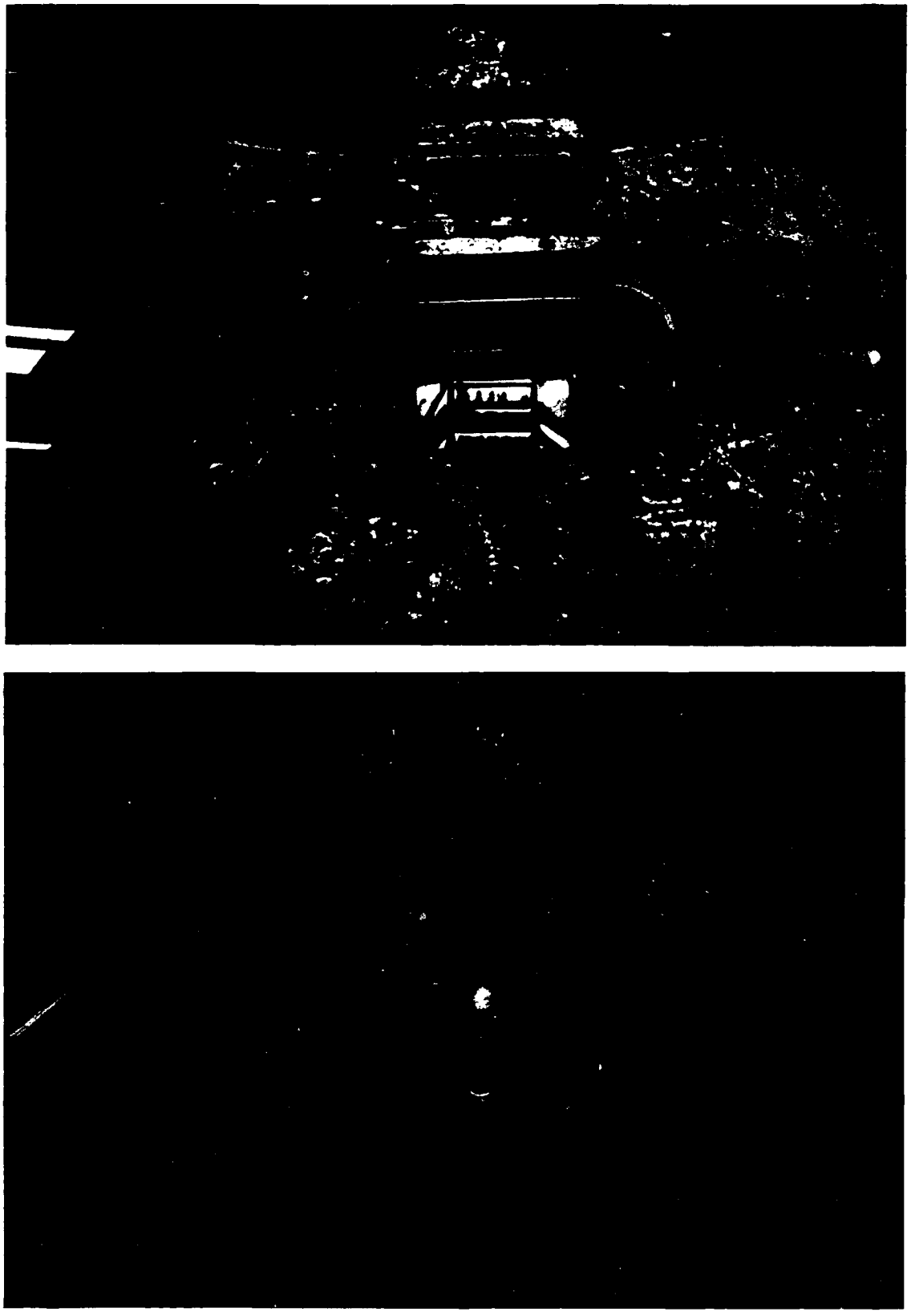

Figure I-2. Driver's Hatch

inadequate. The forward viewing angle through the periscope was estimated as 90 degrees. Upward viewing through the periscope appeared even more restricted, at about 25 degrees from the horizon. The periscope window was provided with wipers and demister system, however, their adequacy could not be judged as they were inoperative.

Open hatch viewing, seat adjusted properly, was rated very adequate. Obstructions to open hatch viewing were presented by stowage boxes located on the forward right and left sponsons.

Access to communications junction boxes was adequate. However, space between the connector socket and bulkhead was only 0.6 inch. This would pose some difficulty to a gloved operator.

Stowage bins for some of the main gun propellent are located to the left and right of the driver's position. Batteries are also located beneath the propellent bins. This arrangement could be hazardous in the event of a fire. Figure I-3 shows the right portion of the driver's station and propellent stowage bins.

Several unique features were found with the Chieftain driver's station. First, a hot water spigot is provided behind and to the left of the position, apparently to make tea. Secondly, the station is equipped with what appears as a gosport or hose apparatus for voice annunciation into the turret area. The device is much like those found on the bridge of old fashioned steamships to talk with the engine room. However, speech intelligibility through the gosport is questionable during all but the quieter moments, such as silent watch. Figure I-4 shows the operation of the device at the mouth piece.

a. Advantages

The driver's station of the Chieftain is arranged to maintain a low tank profile. To do this, the British have designed a semi-reclined seat for closed hatch operation. Except for some outside viewing restrictions, the seat appears adequate on the whole for combat operations. The unique non-electronic voice system, although a primitive technology, serves an important backup role in inter-tank communications. Open hatch driving provides an excellent vantage for maneuvering and observation.

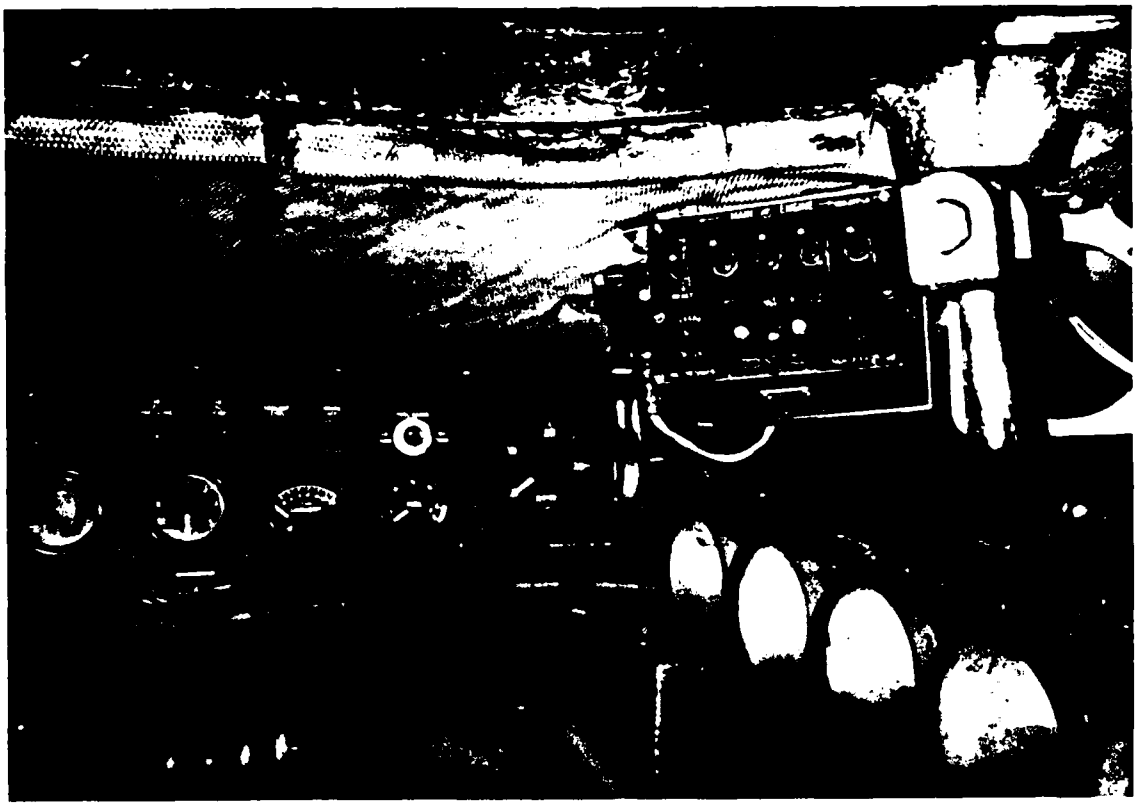

Figure I-3. Driver's Station: Displays, Propellant Stowage Bins on Right

Figure I-4. Driver's Gosport

b. Disadvantages

The use of laterals during closed hatch, semi-reclined driving appeared to be a difficult task to undertake because of the location of the laterals forward of the seat and the periscope positioned behind the hatch. Outside viewing concurrent with control of the laterals, except for the tallest of crewmen, could pose a problem, especially during cross-country maneuvers.

It appeared that the stowage of propellent and wet cell batteries directly next to the driver on either side creates a hazard during all modes of operation. Moreover, accessing the propellent charges during closed hatch operations and passing the charges back into the turret area may lead to damage to the charges, or worse, spillage of propellent into the driver's area.

Finally, although providing hot water for tea may relieve the driver of certain anxieties during combat operations, evaluators consider this a non-combat essential item. Area taken up by the hot water heater hose and spigot could be utilized by additional rations, small arms ammunition, or a host of other combat-related items.

3. Commander's Station

Table I-1 summarizes seating and other selected dimensions for the commander's station. Although the seat pan meets human engineering standards, the seat back falls far short in width and length. The seat adjustability could not be measured because the adjustment control appeared to be hydraulic and could only be operated with the system power on. With the seat adjusted fully down, the head clearance was measured as 38.25 inches, about 1.25 inches short of standards. As such, the station will accommodate the 90th percentile (helmeted) crewman and 95th percentile unhelmeted crewman.

The seat back swings outward and locks with a cross-bar under seat for open hatch seating. Figure I-5 illustrates the seat with seat back in place and with the seat back folded upward.

This arrangement was found to be quite adequate for both open hatch and closed hatch operation. The seat back, when folded up, provides about eight inches in height above the seat pan. This type of

Figure I-5a. Commander's Seat, Seat Back in Normal Position

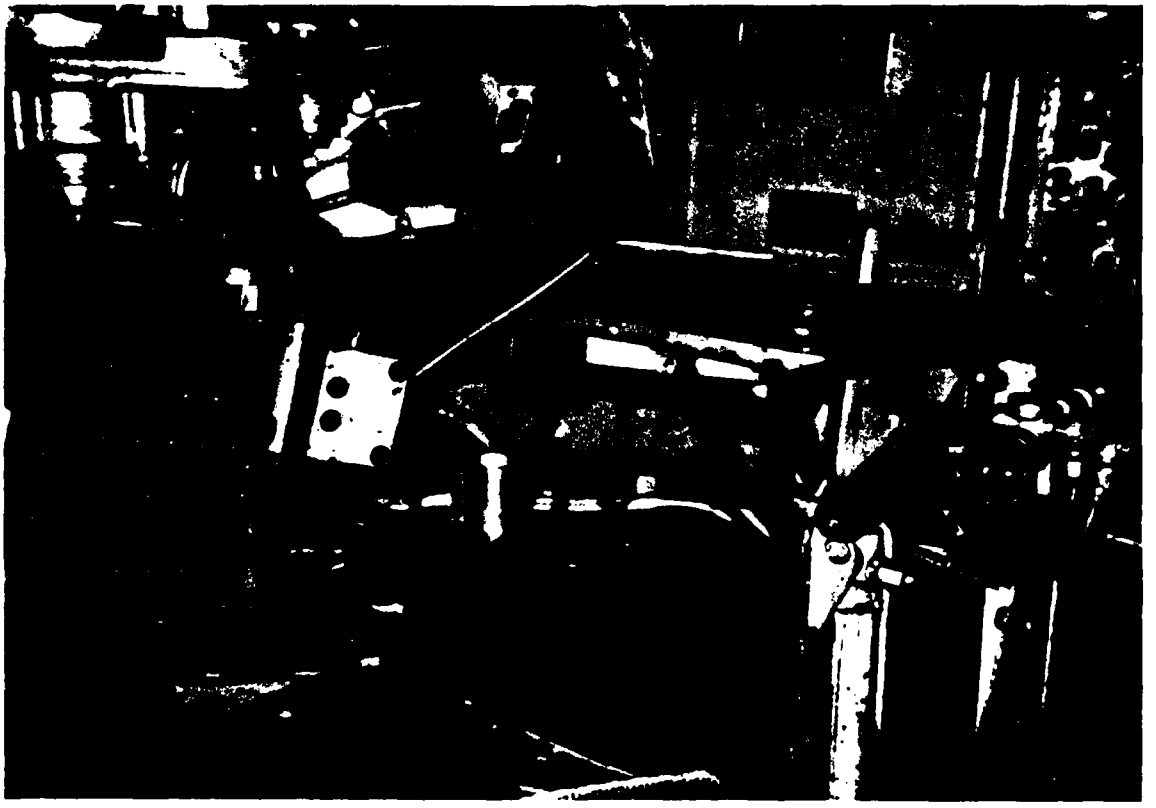

Figure I-5b. Commander's Seat, Seat Back Folded Up

design prevents the seat back from adjusting, and is fixed at 90 degrees. The distance a 95th percentile male operator seated with the seat back in the up position exposed above the hatch rim is 11 inches. Viewing from this vantage is rated as good with the only viewing obstructions being the two hatch pieces.

Ample room for dynamic elbow and arm movement is provided (the left side is completely open for arm movement). Elbow movement is restricted on the right to 26 inches adjusted fully down, and 19 inches adjusted fully up. The latter dimension will accommodate only the 50th percentile male.

The commander is provided with a footrest measuring 11 X 18.5 inches. Footrest depth will accommodate approximately the 75th percentile male with combat boots and the 25th percentile male with arctic or NBC overboots. The platform is not vertically adjustable for standing operations.

Hatch dimensions are shown in Table I-2. Generally, it was surmised that emergency ingress and egress would by very easy. However, 95th percentile crewmen wearing bulky clothing may have a tighter fit, but not tight enough to cause significant delays in movement into or out of the tank. Figure I-6 shows the two-piece rounded hatch design.

Each hatch is provided with a latch and combat lock. Figure I-7 illustrates the latch mechanism for easy opening, closing, and locking. The hatch, however, was not provided with padding and would pose a safety hazard under some circumstances when moving into and out of the station.

The overall effectiveness of the commander's seat, considering all dimensions, comfort, and freedom of movement, was rated as very adequate. The quality of the station for viewing all the the commander's instruments with the seat adjusted fully up, open hatch operation, was good.

All placards and labels at the commander's station were readable, understandable, and placed properly except for the smoke grenade launcher control box. All controls were within easy reach of the commander. The most distant display (the IR control panel) measured

TABLE I-2. HATCH DIMENSIONS

Criteria	13 x 23 in. (light) 16 x 27 in. (bulky)	Evaluator's Ratings
Centurion		
Driver	15.75 x 20.75	4
Cmdr	21.75 dia.	5
Loader	19.25 x 19.25	5
Chieftain		
Driver	15 x 21.25	4 adequate
Cmdr	20.0 dia.	5 very adequate
Loader	20.0 x 17	5
AMX-13		
Driver	14 x 17.5	3 inadequate
Cmdr	18.0 dia.	1 extremely inadequate
Gnr	*17.25 (14.5 in.)	1

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Figure I-6. Commander's Hatch

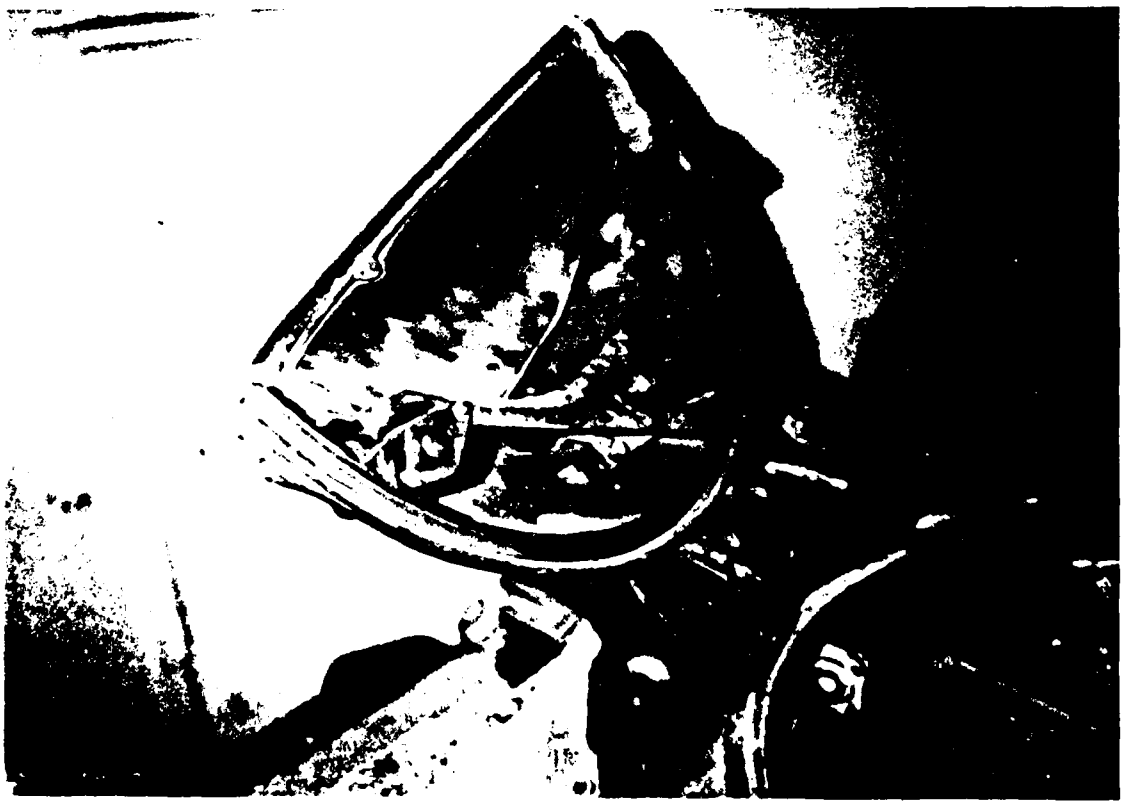

Figure I-7. Commander's Hatch, Hatch Handle, and Combat Lock

23 inches inches from the design eye position. The recommended design eye distance is 15.7 inches (400 mm) for frequent viewing. The nearest display is 8 inches (cupola viewing prism). Visual accessibility was not seen as a problem.

The commander's station is provided with the same NBC collective protection as the other stations. The interface point with which to connect the face mask hose is located at the ventilation port box at the right shoulder area. Access to the box and operation with the hose attached would pose little difficulty during closed hatch operations. The two-port ventilation box provides for directed air flow to the head or torso area.

The commander's hatch measures 20 inches in diameter and appeared to provide very easy movement for a non-NBC or arctic garbed 95th percentile male. The dimensions, however, do not meet minimum standards for hatch width (23 inches) and may cause problems for personnel wearing bulky clothing.

The commander's cupola is provided with two forward-looking wide angle periscopes. Located in between the two periscopes is a telescope with adjustable browpad. Seven other periscopes are fixed along the turret hatch wall, but do not provide true 360 degree unity vision. The outside viewing, closed hatch, through periscopes and telescope in the cupola for target acquisition and surveillance was considered adequate. The commander is provided with a means for clearing his periscopes of dirt, dust, rain, etc. without exiting the vehicle.

For map reading and other tasks requiring area lighting, the commander is provided with a light on a 28-inch appendage which could be adjusted as needed. No red or bluegreen lighting filters were observed.

a. Advantages

The major advantage with the design of the commander's station is the ample room provided to perform target acquisition, surveillance, battle management, and other tasks. Although the seat failed to meet dimensional criteria of U.S. standards, it appears to provide a highly functional design for most of the commander's tasks. Cupola traverse and operation of all controls seemed very easy.

b. Disadvantages

An observable disadvantage to the seat design is that once the seat is folded forward and up for seated open hatch operation, there no longer is an adequate seat back against which the commander can lean. During extended operations, this may lead to back fatigue and even injury during rough, cross-country maneuvers.

Also, there is insufficient padding around the hatch rim. This may be considered a safety hazard when operating with the face just at hatch level, especially during cross-country operations.

4. Gunner's Station

Referring again to Table I-1, the gunner's seating dimensions represent the worse case in the Chieftain, falling far short of human engineering criteria of MIL-STD-1472C. The backrest provided only minimal lumbar support and would cause serious back fatigue and possibly injury during operations of over only several hours. All other dimensions of Table I-1 concerning the gunner's station meet the standards.

The gunner's seat adjusts vertically 4 inches. Forward-rearward adjustability was not observed. Also, like the other stations in the Chieftain, restraint systems were not provided. However, it appears that the seat was designed in such a way as to prevent lateral body movement by recessing the seat pan 3 inches between the turret gear cover on the right and the protective wall separating the gunner from the main gun breech on the left. Seat dimensions are 12 inches at the rear and 15 inches at the front. This arrangement poses a very tight fit for crewmen exceeding the 5th percentile, with light clothing (Hip breadth, sitting, Table 2-68, MIL-HDBK 759A). Overall, the seat was evaluated as inadequate for arctic or NBC MOPP clothed crewmen.

Viewing all instruments was accomplished very easily. The seat reference point (SRP) to the nearest control (powered traverse handle) is 13 inches. The most distant control was measured 24 inches from the SRP. All of the controls observed were very accessible for the seated operator.

Figure I-8 shows the general layout of the gunner's station looking front and right.

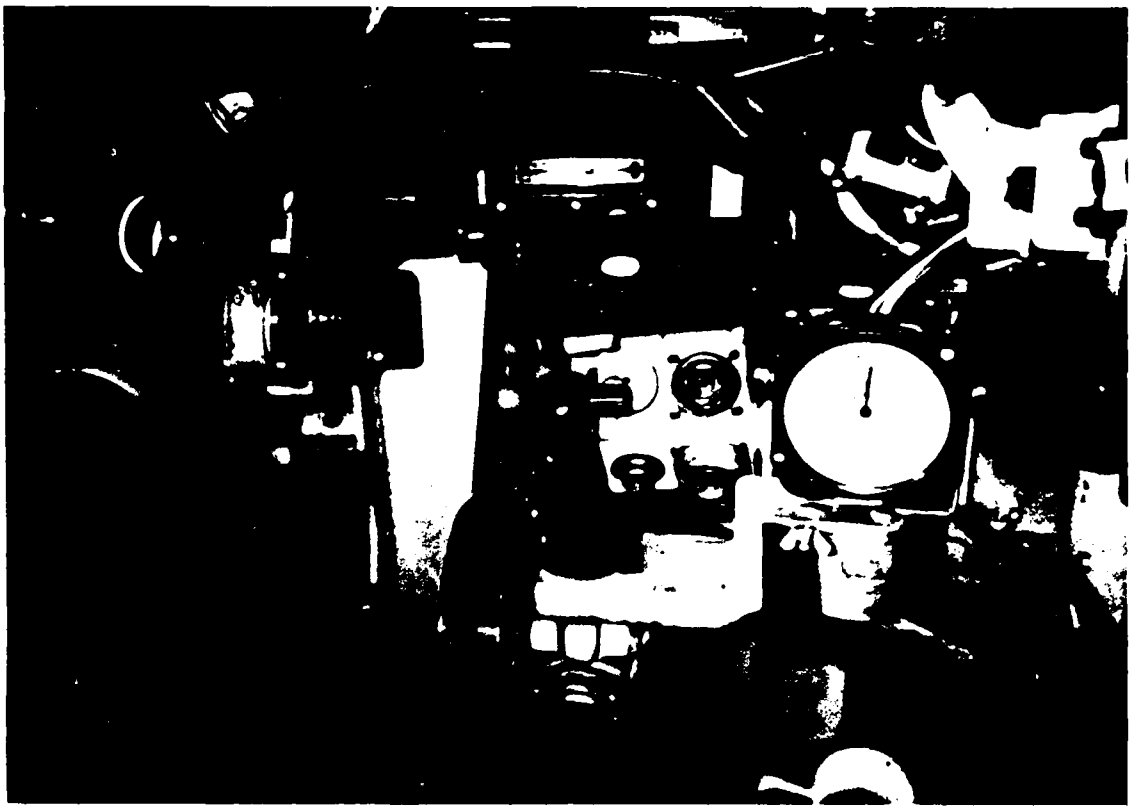

Figure I-8a. Gunner's Controls and Displays

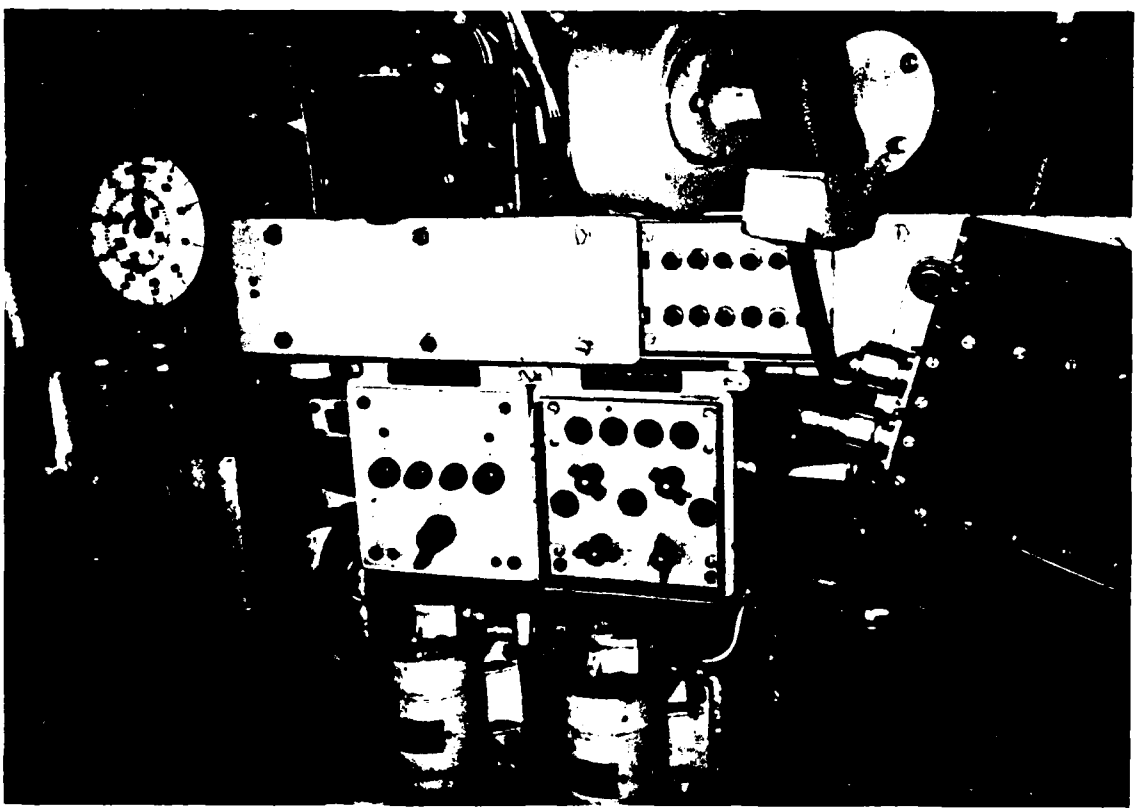

Figure I-8b. Gunner's Station, Right Portion

A hazardous protrusion exists between the telescope and periscope sight to the immediate left and just forward of the gunner. This device (apparently an elevation level, measuring only three inches from the design eye) could cause serious injury to the eye and forehead. The boresight periscope, located forward of the gunner, is provided with a browpad 1.0 inch thick (25.4 mm; 23 mm recommended as minimum thickness). The gunner's telescope located to the left is also provided with a browpad.

Sufficient clearance (2.5 inches) is provided between the manual elevation handle and the nearest object. Adequate clearance is also provided for operation of the manual traverse handwheel (1.5 inches to nearest object). The fire control handle, azimuth indicator, communications box, powered elevation/traverse handle, and other controls and displays at the gunner's station appear adequately arranged for efficient, safe, and effective operation.

A peculiarity observed at the Chieftain gunner's station concerns the four knobs on the trimming unit box. The knobs are designed with a very rough or bumpy surface to assure a firm grip and high tactile feedback when manipulating with the fingers.

The display colors are generally red, green, and black on a white background. Indicator lights appear to be grouped sequentially and color-coded according to standards.

The gunner's ventilation port is located between the fire control handle and azimuth indicator. Air can be directed at the face and upper torso of the gunner. It appeared that a ventilation hose from the individual's face mask to the ventilation port could interfere with the operation of the fire control handle and manual traverse and elevation controls.

As mentioned in the evaluation of the driver's station, the area provided at the gunner's foot area for driver emergency egress is restricted, making movement to and from extremely difficult. Figure I-9 shows the gunner's seat and opening at the bottom of the turret cage for driver egress.

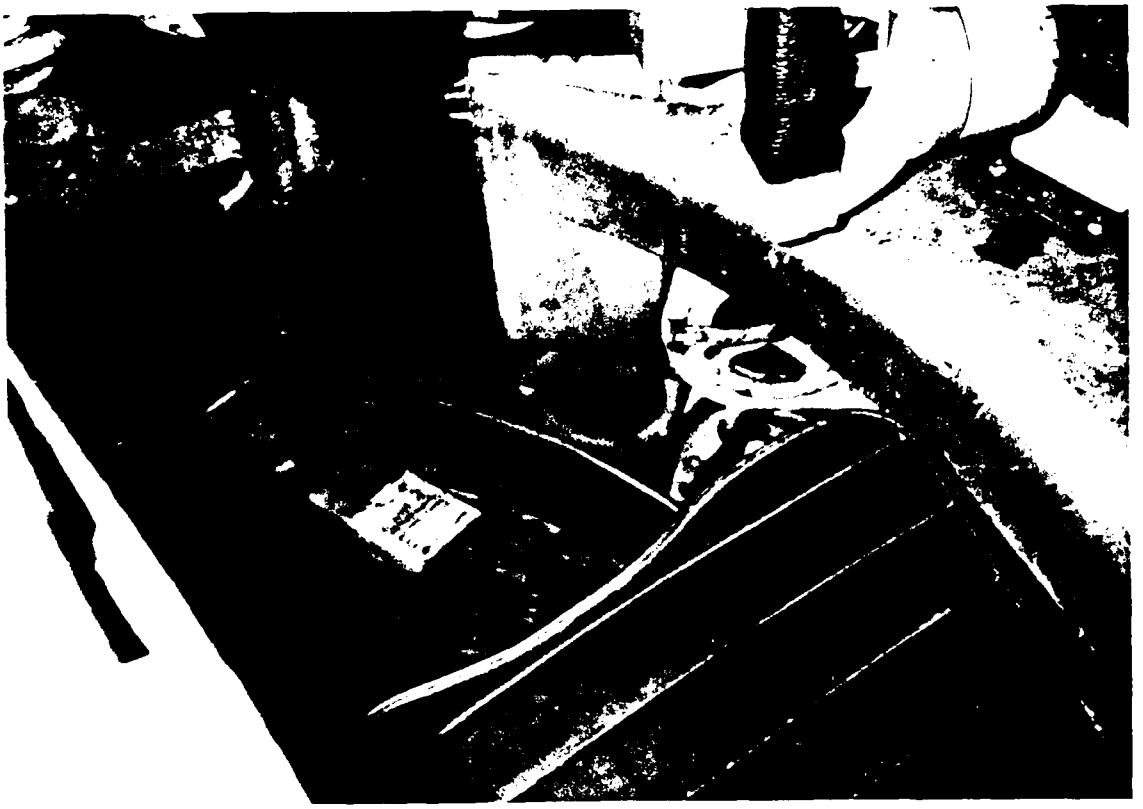

Figure I-9. Gunner's Seat

a. Advantages

The major advantage of the gunner's station is the location and arrangement of most of the critical controls and displays. The powered elevation and traverse handle as well as the controls for manual elevation and traverse were located for quick and easy operation.

b. Disadvantages

The gunner's station lacked a chest support for cross-country fire control operations. Also, the browpad appeared inadequate for this task.

The seat design has much to be desired. Larger soldiers would find it difficult to fit the seat pan, especially when wearing arctic or NBC MOPP clothing.

The location of the powered traverse and elevation handle, although convenient for operation, is such to be struck inadvertently by

the right leg of the gunner and could be easily activated. Also, the right knee of a 95th percentile gunner strikes the power cables exiting the powered elevation and traverse control box.

Finally, the elevation level protruding into the gunner's face area presents an extreme hazard, even to the helmeted crewman.

5. Loader's Station

The loader's seat was not present in the subject vehicle. Figure I-10 shows the loader's station in the Chieftain from several perspectives. The propellent containers for the two-piece ammunition are located throughout the tank. Most occupy the floor. The projectile racks are seen at the very back of the turret bustle, with other projectiles stowed throughout the tank. Some of the propellent stowage bins (e.g., those located next to the driver, etc.) appeared difficult to access quickly.

The loader must stand forward and to the side of the main gun breech to avoid being hit by the gun recoil. The only design precaution taken to protect the loader from recoil is a metal bar and plate located at the bottom, below the breech.

There were no dedicated steps for climbing into and out of the loader's station. The most convenient foothold would be the projectiles. Projectile racks are seen in Figure I-10b.

Figure I-11 shows the rear-most aspect of the turret, between the commander and the loader's station. Notice the heating vessel with brass spigot to boil water for tea and other hot beverages.

The ceiling and walls of the tank are covered with 0.5 inch foam padding for acoustic attenuation and protection from contact injuries.

Generally, the workspace provided was rated as adequate. However, a designated "safe area" where the loader could stand or sit to avoid injury from the 120 mm main gun recoil was not observed. The free standing space for loader operations is limited to 12 x 17 inches.

Figure I-10a. Loader's Station Next to Gun Breech

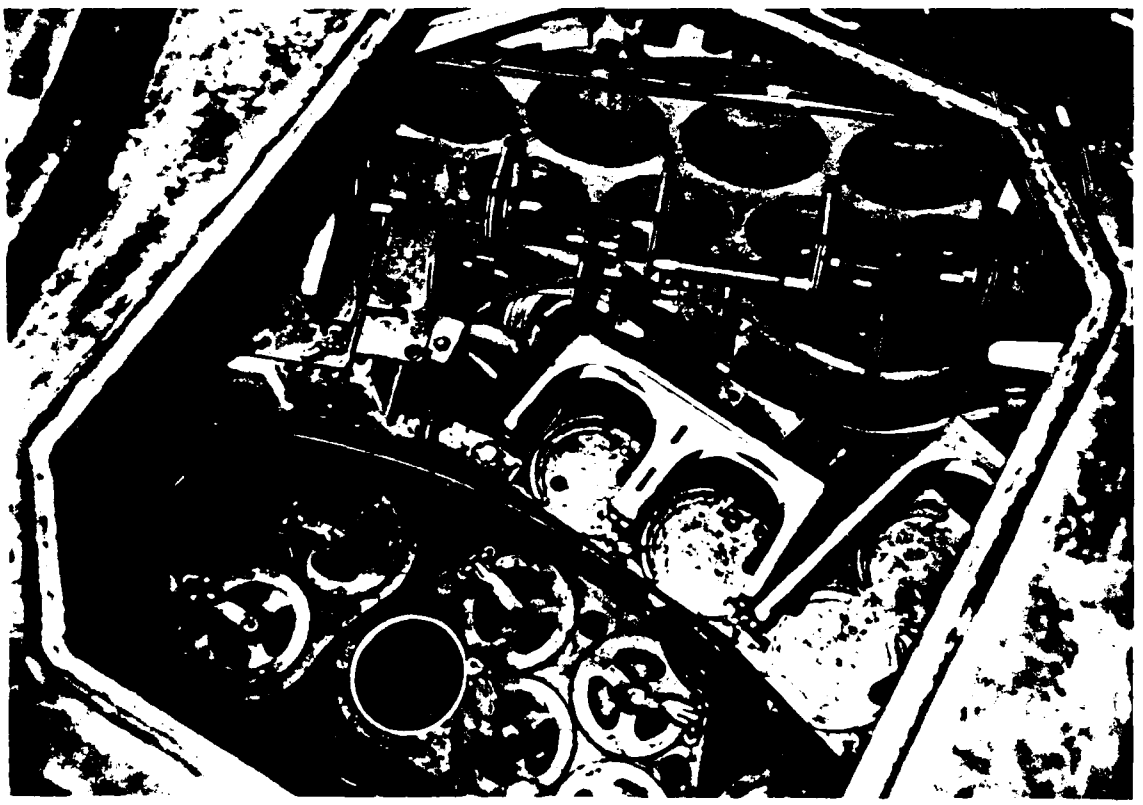

Figure I-10b. Loader's Station, Looking Down Through Hatch

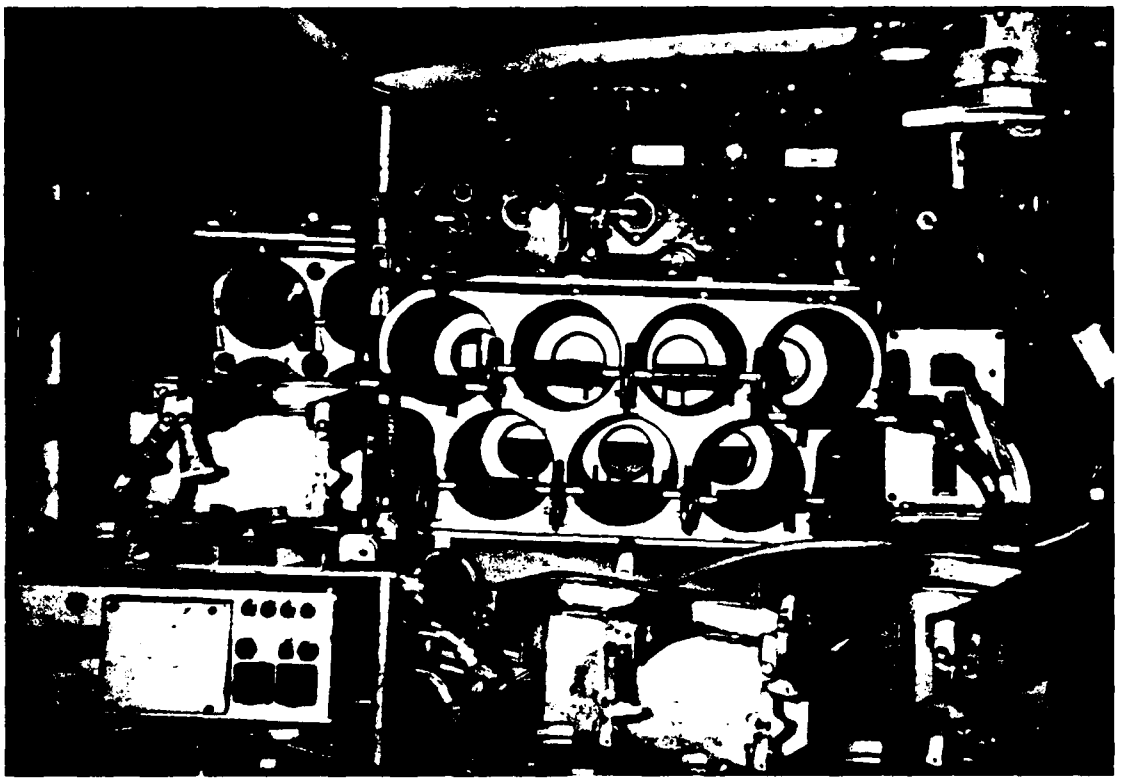

Figure I-10c. Loader's Station, Looking Rearward

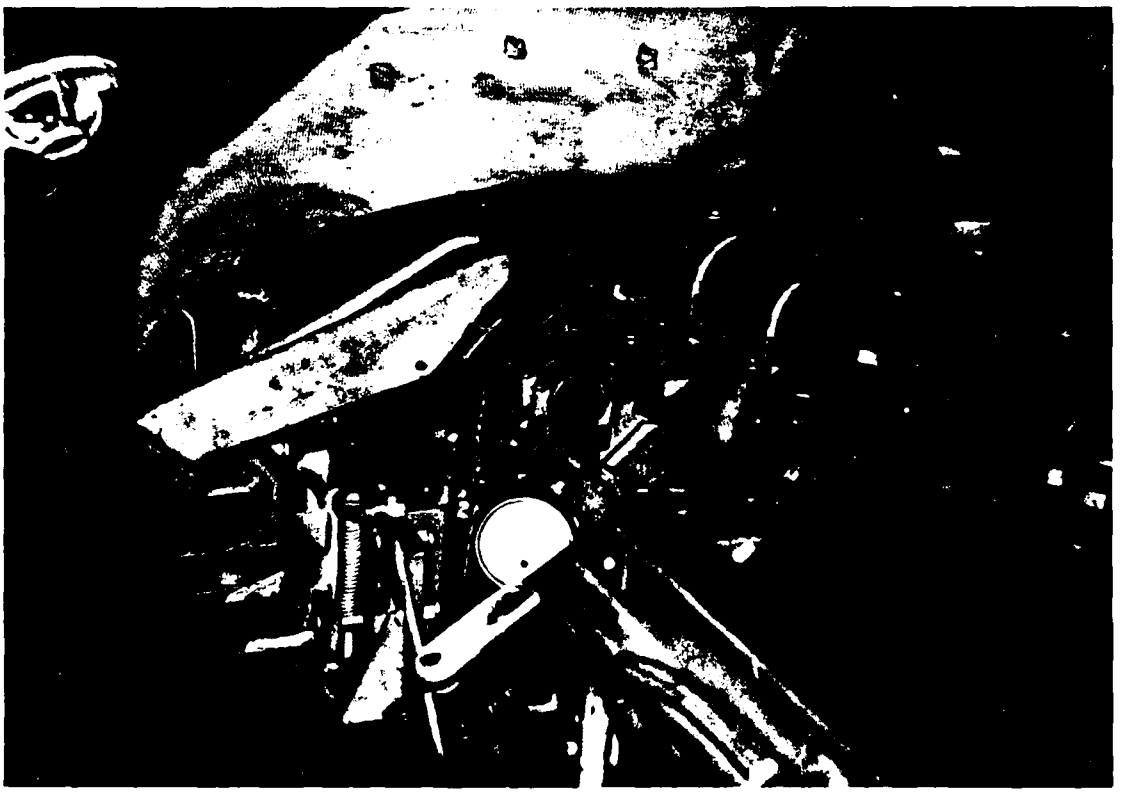

Figure I-10d. Loader's Station, Coax, RMG Mounts, and Main Gun Breech

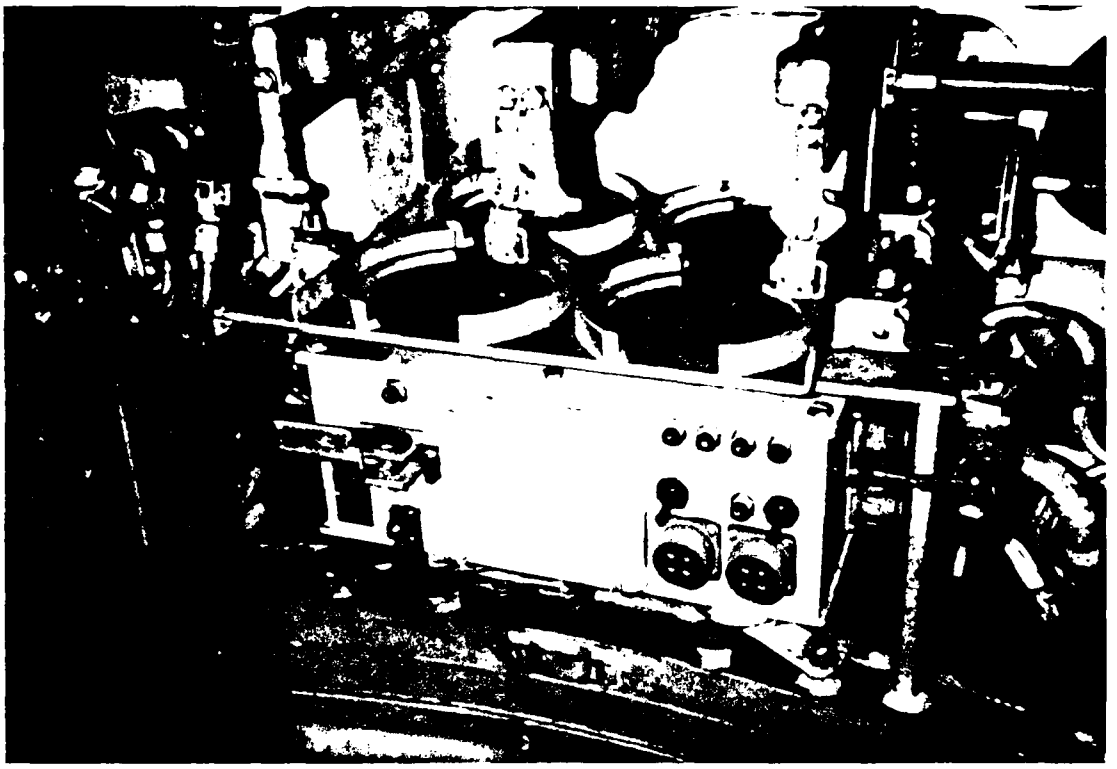

Figure I-11. Projectile Mounts, Heating Vessel for Tea

From appearances, main gun resupply through the loader's hatch and uploading from stowage would be relatively easy. Uploading propellent from the driver's area during main gun firing would be difficult without damaging the propellent bags.

Three pressure gauges of the older "steam gauge" type are provided. Although archaic in technology, they present the loader with a quick and easy visual indication of pressure conditions.

The loader is responsible for the mounting, loading, clearing, and charging of the 7.62 mm coaxial machine gun, located next to the breech and the .50 cal ranging machine gun, located to the left of the coaxial machine gun. Machine gun positions are shown in Figure I-10d.

The machine guns are very accessible for operation and maintenance.

The loader is also provided with a periscope that is limited to observation of the front and front-left of the tank, to about the left rear area.

Generally, the loader's controls and displays are adequate for loading, maintenance, and communications tasks. The radio is located in the left turret bustle area and provides adequate visual and manual access. Displays are black on white and red on white. Indicator lights appeared color-coded in accordance with human engineering standards.

The switches operating the boiling vessel have no protective guards or covers and could be inadvertently activated. Also, the water spigot is exposed to accidental contact and damage.

The loader is provided with the same type of ventilation system consisting of a two-port directional vent with a connector for the individual's face mask. Adequate access to the ventilation system is provided.

The loader's hatch is similar to that of the Centurion. It is of two-piece construction, easily opened forward and to the rear of the vehicle. Figure I-12 shows the loader's hatch open.

Figure I-13 displays a detailed view of the loader's hatch area, looking down into the rear bustle projectile stowage area.

Hatch dimensions are shown in Table I-2. Dimensions satisfy human engineering requirements for lightly clothed 95th percentile crewmen. According to the standards, arctic or NBC MOPP garbed personnel may have some difficulty in movement into and out of the tank. However, evaluators felt that the hatch would likely pose no serious problems in movement regardless of dress. The only difficulty found with the loader's hatch was release of the hatch from a lock-open to closed position. The latch mechanism, it was surmised, may have been rusted or fouled from storage.

Also, the loader's intercommunications box provides no clearance between the connector and bulkhead. Connecting the helmet communications wire with the intercommunications box would be very difficult, especially with arctic or NBC handwear.

a. Advantages

Again, the primary advantages of the loader's station, except for the restricted foot space, is the ample area provided to conduct loading and maintenance tasks. Spare room is available for

Figure I-12. Loader's Hatch Arrangement

Figure I-13. Loader's Hatch, Projectile Stowage Racks

installing and maintaining both machine guns. Ready rounds are very accessible. The retainer mechanism for bustle ready projectiles is easily operated, although the loader could utilize the racks as a foot hold entering or exiting the tank.

b. Disadvantages

The standing floor space is limited to a very narrow area. Movement toward the rear during main gun firing could subject the loader to injury from gun recoil. An adequate foothold for entering and exiting the station is not provided.

6. Crew Integration, Safety, Health Hazards

The relative simplicity of the Chieftain should allow relatively easy cross training among crew members.

With a reduced three or two man crew, the tank appeared capable of operation, at least of firing from a stationary mode. It also appeared improbable that workload breakdown during combat would occur.

The use of arctic or NBC MOPP gear would cause only minimal degradation in crew performance during short periods. However, the NBC collective protection system would serve only limited use during extended operations, especially in warm or hot climates. The driver would find it very difficult to move from his station wearing bulky clothing in an emergency. Although generally provided with ample room to move about, workspace (except for the loader) is barely adequate to allow crew members to don and doff arctic and NBC gear, especially in a hurry.

The Chieftain could use more padding over potentially hazardous protrusions and the hatch rims to prevent injury to crews.

Noise, vibration, and toxic fumes hazards could not be evaluated because the system was inoperable during the evaluation. However, the 120 mm main gun is provided with a bore evacuator system and overpressure to reduce the concentration of noxious fumes during fire missions.

Portable fire extinguishers are provided and are accessible to each crew member. Separate fire extinguishers are provided in addition to the automatic system currently in use in upgraded vehicles.

Accessibility to weapons and other stowed items on board is generally very good. Workspace provided for maintenance in the turret area is adequate. However, maintenance access to electrical items in the far reaches of the driver's station would pose a severe access problem, especially under operational conditions.

Otherwise, most cables, conduits, etc. are labeled clearly and appeared accessible for repair and replacement. The fuel inlet was very accessible and would pose no special problems under any circumstances.

Stowage space also appeared adequate for replacement items such as road wheels, track blocks, firing pins, etc. for transport into combat. Adequate area is provided inside for stowage of personal items (e.g., NBC gear, individual weapons and ammunition, etc.). Additional stowage space outside is provided in stowage bins located on either sponson.

Skirts on each side protecting the tracks and road wheels appear designed for quick and easy removal by use of simple lug bolts.

The Chieftain's design displayed insufficient protection to prevent inadvertent ignition/explosion of main gun propellent. As mentioned previously, transfer of propellent sacks from the driver's area into the turret may cause damage to the containers and spillage of propellant.

7. Evaluator's Ratings

Table I-3 presents a summary of the ratings over 135 items in the human factors engineering armor data base. Seventy-eight percent of the ratings were positive; 30 percent are very positive and extremely positive. The ratings provide only an indication of the subjective impressions by evaluators and imply no cause and effect conclusions.

C. DISCUSSION

The Chieftain design was the first attempt to develop a battle tank in which a semi-reclined seat was incorporated into the driver's station. This approach allows a lower overall vehicle profile and a higher survivability on the battlefield. Although improvements are needed in

TABLE I-3. STATISTICAL SUMMARY OF EVALUATOR'S RATINGS, BRITISH CHIEFTAIN MBT

TARGET SYSTEM RATING VALUES	1 EXTREMELY NEGATIVE	2 VERY NEGATIVE	3 NEGATIVE	4 POSITIVE	5 VERY POSITIVE	6 EXTREMELY POSITIVE
CHIEFTAIN						
GENERAL,BOARDING,ETC.	0	1	2	3	0	3
DRIVER STATION	0	3	3	11	9	0
COMMANDER STATION	0	1	4	11	13	0
GUNNER STATION	0	0	2	9	7	0
LOADER STATION	0	1	7	14	4	0
CREW INTEGRATION	0	1	5	17	4	0
TOTAL = 135	0	7	23	65	37	3
POSITIVE RESPONSES = 78%						
NEGATIVE RESPONSES = 22%						

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the seat design (i.e., head rest), the crewstation is generally adequate for combat operations.

The Chieftain also reflects a curious desire by British engineers to include features that would be considered outdated by some United States tank designers. For example, the driver is provided with a gosport to communicate with the commander in the event of a power failure, rendering the electronic headset unusable. The use of older "steam gauges" at the gunner's and loader's stations conveys an older, almost archaic design. However, the use of these antiquated methods are also usually highly reliable and maintainable compared with digital, computer dependent components.

Evaluators were most impressed by the discovery of a hot water (boiling) apparatus, apparently for tea, and accompanying plumbing to the turret and driver areas. Crew comfort, especially during extended operations and operations in extreme climatic conditions, is an important factor in achieving an optimal soldier-system interface. It seems, however, that the area taken up by the additional pipes and fixtures could have been better utilized. For example, additional ammunition, water, rations, or other combat related items could have been planned in place of the tea making apparatus.

ATTACHMENT 2

HUMAN FACTORS ENGINEERING DATA BASE FOR THE BRITISH CHIEFTAIN MBT

Human Factors Engineering Data Base
File Name: AMR7
Evaluator's Rating Scales

0300 Evaluator's Rating Scale 1
6 = Extremely adequate
5 = Very adequate
4 = Adequate
3 = Inadequate
2 = Very Inadequate
1 = Extremely inadequate

0304 Evaluator's Rating Scale 2
6 = Extremely easy
5 = Very easy
4 = Easy
3 = Difficult
2 = Very difficult
1 = Extremely difficult

0306 Evaluator's Rating Scale 3
6 = Extremely good
5 = Very good
4 = Good
3 = Poor
2 = Very poor
1 = Extremely poor

0308 Evaluator's Rating Scale 4
6 = Extremely accessible
5 = Very accessible
4 = Accessible
3 = Inaccessible
2 = Very inaccessible
1 = Extremely inaccessible

0310 Evaluator's Rating Scale 5
6 = Definitely not dangerous/hazardous
5 = Probably not dangerous/hazardous
4 = Maybe not dangerous/hazardous
3 = Maybe dangerous/hazardous
2 = Probably dangerous/hazardous
1 = Definitely dangerous/hazardous

0312 Evaluator's Rating Scale 6
6 = Extremely effective
5 = Very effective
4 = Effective

3 = Ineffective
2 = Very ineffective
1 = Extremely ineffective

0314 Evaluator's Rating Scale 7
6 = Extremely improbable
5 = Very improbable
4 = Probably not
3 = Probably
2 = Highly likely
1 = Extremely likely

0316 Color coding IAW MIL-STD-1472C
Red = Critical; stop; emergency
Yellow = Caution; slow down
Green = Safe; go
White = ON; general status; operating

0318 Control movement IAW MIL-STD-1472C
ON = Up, right, clockwise, pull
OFF = Down, left, counter-clockwise, push
Increase = Forward, up, right, clockwise
Decrease = Rearward, down, left, counter-clockwise

0342 Abbrev; Cmdr = Commander

0344 Abbrev; Com = Communications

0348 Abbrev; CVC = Combat vehicle crewman

0352 Abbrev; DAY-CHV = Day-Closed hatch viewing

0354 Abbrev; dB(A) = decibels, A-weighted

0358 Abbrev; Dvr = Driver

0360 Abbrev; FLIR = Forward looking infra red

0364 Abbrev; ft-C = Foot-candles

0368 Abbrev; FOV = Field of view

0370 Abbrev; Gnr = Gunner

0372 Abbrev; Hz = Hertz

0374 Abbrev; IAW = In accordance with

0378 Abbrev; Ldr = Loader

0380 Abbrev; lx = Lux

0382 Abbrev; m = meters

0383 Abbrev; MG = machine gun

0384 Abbrev; mm = millimeters

0386 Abbrev; MIL-STD = Military standard

0388 Abbrev; MOPP-4 = Military oriented protective posture, level 4

0390 Abbrev; MRT = Modified rhyme test

0392 Abbrev; N = Newtons

0394 Abbrev; NBC = Nuclear, biological, chemical

0396 Abbrev; NET = New Equipment Training

0397 Abbrev; Rh = Relative humidity

0398 Abbrev; RMG = Ranging machine gun

0399 Abbrev; RMS = Root mean square

0402 Abbrev; SRP = Seat reference point

0406 Abbrev; Sta = Station

0408 Abbrev; SWAT = Subjective Workload Assessment Technique

0408 Abbrev; TECOM = Test and Evaluation Command

0410 Abbrev; TOP = Test Operation Procedures

Human Factors Engineering Data Base
File Name: AMR1
System Profile

0001 Vehicle name, generic and military, (CHIEFTAIN, MK 5 MBT)

0002 Vehicle class; tracked, wheeled; tank, light armored vehicle, etc. (TRACKED, HEAVY MBT)

0004 Vehicle identification, country of origin, (GREAT BRITIAN)

0006 Vehicle identification, manufacture date, (1967)

0008 Vehicle operability, overall condition of vehicle being evaluated, rating scale 3 (4)

0010 Vehicle operability, automotive condition, engine/drive train of vehicle being evaluated, (OPERATIVE BUT IN STORAGE)

0012 Vehicle operability, weapon condition, main gun, (OPERABLE)

0014 Vehicle operability, weapon condition, coax machine gun, (COAX NOT MOUNTED)

0018 Vehicle operability, weapon condition, commander's weapon, (WEAPON NOT MOUNTED)

0020 Crew number, total, (4)

0021 Crew location, driver, (FRONT, CENTER HULL)

0022 Crew location, gunner, (RIGHT, LOWER TURRET AREA)

0023 Crew location, commander, (RIGHT, UPPER TURRET AREA)

0024 Crew location, loader, (LEFT TURRET AREA)

0025 Crew location, infantry passengers, (NONE)

0026 Cannon, stabilization (YES)

0028 Turret, traverse limits (360 DEGREES)

0030 Cannon, rate-of-fire, (8-10 RNDS/MINUTE FIRST MINUTE; 6 RNDS/MINUTE THEREAFTER)

0040 Cannon, turret traverse rate, (mils/sec)

0044 Mobility, fording prep time, (mils/sec)

0048 Cannon, autoloader, description, (N/A)

0050 Cannon, autoloader, manual assist, description, (N/A)

0052 Cannon, ammo, storage, location, (TWO-PIECE 120MM L11A5 AMMUNITION; PROPELLENT IN CONTAINER BINS ON TURRET FLOOR AND DRIVER AREA; PROJECTILES IN TURRET BUSTLE)

0054 Coax MG, type (L8A1 MG)

0056 Coax MG, caliber (7.62MM)

0058 Coax MG, fire control (INTEGRATED WITH GNR'S PRIMARY FIRE CONTROL SYSTEM)

0060 Cmdr's weapon, cupola, description, (M37A1 MG; 7.62MM)

0062 Cmdr's weapon, elevation limits, (degrees)

0064 Cmdr's weapon, traverse limits, (360 DEGREES)

0080 Main weapon, fire control, system type, (MARCONI FIGHTING VEHICLE GUN CONTROL EQUIPMENT (FV/GCE) NO 7 MK4; INTEGRATED FIRE CONTROL SYSTEM)

0082 Main weapon, fire control, range finder, type, (12.7MM (.50 CAL) L21A1 RANGING MG; BARR AND STROUD TANK LASER SIGHT UNIT, NO 1 MK 1 AND 2)

0084 Main weapon, fire control, ballistic computer, description, (INTEGRATED FIRE CONTROL SYSTEM, DIGITAL COMPUTER (MARCONI 12-12P); SUBSYSTEMS ARE DATA HANDLING SUBSYSTEMS, TANK LASER SIGHT, GUN CONTROL EQUIPMENT)

0086 Main weapon, fire control, ammo selector, description, (MANUAL SELECT CONTROL)

0088 Searchlight, model (GEC-MARCONI ELECTRONICS INFRA-RED/WHITE LIGHT)

0090 Searchlight, field of view (degrees)

0092 Searchlight, effective range (IR = 1000M; WHITE LIGHT = 1500M)

0094 Main weapon, fire control, telescope, model (text)

0096 Main weapon, fire control, telescope, MAG, (power)

0098 Main weapon, fire control, telescope, FOV, (degrees)

0120 Main weapon, fire control, location, (GNR'S STA, CMDR'S STA (BACK-UP)

0124 Main weapon, fire control, FLIR, model (text)

0126 Main weapon, fire control, FLIR, MAG (power)

0128 Main weapon, fire control, FLIR, FOV (degrees)

0130 Main weapon, fire control, FLIR, location (text)

0140 Main weapon, fire control, range finder, MAG (power)

0144 Main weapon, fire control, range finder, FOV (degrees)

0146 Main weapon, fire control, range finder, location (text)

0148 Main weapon, fire control, range finder, accuracy (text)

0150 Gun azimuth indicator, description (GNR'S STA; CMDR'S STA; DVR'S STA)

0156 Ident Friend-Foe, (text)

0160 NBC protection, type, collective protection; individual, (COLLECTIVE PROTECTION)

0166 NBC filter, type (FILTER PACK)

0168 NBC collective protection, type, overpressure/etc., (OVERPRESSURE; INDIVIDUAL SUITS)

0174 NBC individual protection, type, (text)

0176 NBC individual protection, filter type (text)

0178 NBC agent detector, type (text)

0180 NBC agent detector, location (text)

0190 Engine, location (VEHICLE REAR)

0196 Engine, maintenance access, interior (NONE)

Human Factors Engineering Data Base
File Name: ARMR1
General, Boarding, Movement

2004 Handholds/footholds, adequacy of boarding using, rating scale 1 [4]

2005 Boarding handholds, grasp space [NONE PRESENT]

2006 Boarding footholds, dimensions, L x W, [mm; 3 IN. FOOT-TOE HOLD PROVIDED BY TRACKS]

2008 Non-skid surfaces, adequacy of, rating scale 2 [1]

2009 Obstructions boarding vehicle? [NO]

2010 Alternate boarding paths? [YES; FRONT-REAR TRACK SECTIONS]

2011 Alternate emergency hatch provided? [NO]

2100 Inter-crew station passage, difficulty moving from primary entrance hatch to loader's station, rating scale 2 [6]

2101 Inter-crew station passage, average time to move from primary entrance to loader's station (no. trials; seconds)

2102 Inter-crew station passage, difficulty moving from primary entrance hatch to cmdr's station, rating scale 2 [6]

2103 Inter-crew station passage, average time to move from primary entrance to cmdr's station (no. trials; seconds)

2104 Inter-crew station passage, difficulty moving from primary entrance hatch to gunner's station, rating scale 2 [6]

2105 Inter-crew station passage, average time to move from primary entrance to gunner's station (no. trials; seconds)

2106 Gunner's seat back, must be removed to enter station? [NO]

2108 Driver's ingress from turret to station, must turret be rotated? [YES; SPACE AT GNR'S FOOT TO EGRESS INTO TURRET; ROTATE TURRET ABOUT 80 DEGREES]

2109 Driver's ingress from turret to station, average time, non-NBC garbed, (no. trials; seconds)

2111 Driver's ingress from turret to station, average time, NBC garbed, (no. trials; seconds)

2113 Driver ingress from turret to station, effort required, NBC

garbed, rating scale 2 [3]

2115 Emergency egress, adequacy of moving from driver sta to turret, rating scale 2 [3]

2117 Dead weight drag, ease of dead weight drag from driver station into turret, rating scale 2 [2]

2118 Dead weight drag, from driver station into turret, average time, NBC garbed (no. trials; seconds)

2119 Dead weight drag, from driver station into turret, average time, non-NBC garbed (no. trials; seconds)

2120 Dead weight drag, from gunner station to outside vehicle, ease of, rating scale 2 (4)

2121 Dead weight drag, from gunner station to outside vehicle, average time, NBC garbed (no. trials; seconds)

2122 Dead weight drag, from gunner station to outside vehicle, time, non-NBC garbed (no.; seconds)

2124 Dead weight drag, from cmdr station to outside, thru cmdr's hatch, ease of, rating scale 2 [4]

2125 Dead weight drag, from cmdr station to outside, thru cmdr's hatch, average time, non-NBC garbed, (no. trials; seconds)

2126 Dead weight drag, from cmdr station to outside, thru cmdr's hatch, average time, NBC garbed (no. trials; seconds)

Human Factors Engineering Data Base
File Name: AMR2
Driver's Station

3005 Dvr sta, seat back dimensions, l x w (18.25 X 14.25 IN.)

3010 Dvr sta, seat pan dimensions, IAW MIL-STD-1472C, Fig 50, l x w, (18.25 X 16.25 IN.)

3012 Dvr sta, seat padding, thickness, IAW MIL-STD-1472C, Fig 50, (3.75 IN.)

3014 Dvr sta, seat back rest-to-seat angle, IAW MIL-STD-1472C, Fig 50, (degrees) NOTE: ADJUSTABLE FULL DOWN

3016 Dvr sta, seat slope, IAW MIL-STD-1472C, Fig 50, (degrees)

3018 Dvr sta, distance from seat front, top of padding, to floor, IAW MIL-STD-1472C, Fig 50, (11 IN. FULL DOWN)

3020 Dvr sta, seat vertical adjustability, IAW MIL-STD-1472C, Fig 50, (10.5 IN.)

3022 Dvr sta, seat forward-rearward adjustability, IAW MIL-STD-1472C, Fig 50, (range in mm; in.)

3024 Dvr sta, MIL-STD-1472C, Table 28 dimension A, Elbow, dynamic, (35 IN.)

3026 Dvr sta, MIL-STD-1472C, Table 28 dimension B, Elbow, static, (27.5 IN.)

3028 Dvr sta, MIL-STD-1472C, Table 28 dimension C, Shoulder, (20 IN.)

3030 Dvr sta, MIL-STD-1472C, Table 28 dimension D, Knee width, minimum, (16 IN.)

3032 Dvr sta, MIL-STD-1472C, Table 28 dimension E, Knee width, maximum, (26 IN.)

3034 Dvr sta, MIL-STD-1472C, Table 28 dimension F, Boot clearance from pedal, (mm; in.)

3036 Dvr sta, MIL-STD-1472C, Table 28 dimension G, Distance between pedals, (3 IN.)

3038 Dvr sta, MIL-STD-1472C, Table 28 dimension H, Boot clearance from brake pedal, (11 IN.)

3040 Dvr sta, MIL-STD-1472C, Table 28 measurement 1, head clearance, closed hatch, SRP to underside of hatch, (26 IN.)

3042 Dvr sta, MIL-STD-1472C, Table 28 measurement 2, abdominal, seat back to steering device, (26 IN.)

3044 Dvr sta, MIL-STD-1472C, Table 28 measurement 3, front of knee, seat back to closest forward object, (21 IN.)

3046 Dvr sta, MIL-STD-1472C, Table 28 measurement 4, seat depth, SRP to front edge of seat pan, (14 IN.)

3050 Dvr sta, MIL-STD-1472C, Table 28 measurement 7, boot, front of seat pan to heel point of accelerator, (14.5 IN.)

3052 Dvr sta, adequacy of viewing and operating hand and foot controls, viewing displays in all vertically adjusted seat positions, open/closed hatch, rating scale 1 (4)

3054 Dvr sta, seat, adequcy of lumbar support, rating scale 1 (4)

3056 Dvr sta, seat provided with restraint,seat belts? (NO)

3058 Dvr sta, seat, adequacy of seat restraint/seat belt system, rating scale 1 (1-6)

3060 Dvr sta, seat designed to prevent bloodflow to popliteal area? (YES)

3062 Dvr sta, seat provided with adjustable headrest? (YES; INOPERABLE)

3064 Dvr sta, seat material, promote excessive perspiration during estended operations? (YES)

3066 Dvr sta, seat material, become excessively hot during operations in hot conditions? (YES)

3068 Dvr sta, adequacy of emergency steering or evasive maneuvers, rating scale 1 (1-6)

3070 Dvr sta, adequacy of emergency braking, rating scale 1 (1-6)

3072 Dvr sta, closed hatch, non-NBC, adequacy of ventilation (use of fresh outside air), rating scale 1 (1-6)

3074 Dvr sta, daylight driving, open hatch, reflective glare on instruments? (YES)

3076 Dvr sta, open hatch, adequacy of rear view mirror, rating scale 1 (4)

3078 Dvr sta, seat back material, (VINYL)

3080 Dvr sta, head rest material, (VINYL)

3082 Dvr sta, distance closest hand control from SRP (17 IN.)

3084 Dvr sta, adequacy of access and operation of hand/foot controls, rating scale 1 (4)

3086 Dvr sta, visibility, quality of visibility of controls/displays, day and night operations, rating scale 3 (4)

3088 Dvr sta, visibility; viewing distance to most distant display (40 IN.)

3090 Dvr sta, visibility; viewing angle from design eye position to worse condition primary display (degrees)

3092 Dvr sta, adequacy of displays for critical driving tasks, rating scale 1 (4)

3094 Dvr sta, display functions grouped together? (YES)

3096 Dvr sta, closed hatch, displays readable? (NO; NOT ALL FROM CLOSED HATCH POSITION)

3097 Dvr sta, master caution light provided? (NO)

3098 Dvr sta, master caution light, distance, angle from design eye postion, (mm; in./degrees)

3099 Dvr sta, master caution light, range of luminance, (range in lx; ft-C)

3100 Dvr sta, master caution light, color (text)

3101 Dvr sta, displays illuminated? (YES)

3102 Dvr sta, primary display color (WHITE ON BLACK)

3103 Dvr sta, display luminance range, (lx; ft-C)

3104 Dvr sta, display luminance variable control? (YES)

3105 Dvr sta, spot brightness values, primary displays, (display type; location; ft-L)

3106 Dvr sta, primary displays, color-coded efficiently? (YES)

3107 Dvr sta, luminance controls provided with full OFF? (Yes/No; INOPERABLE)

3108 Dvr sta, indicator lights, grouped together, close to driver's line of sight? (YES)

3110 Dvr sta, indicator lights, colored correctly, IAW MIL-STD-1472C? (YES)

3112 Dvr sta, indicator lights testable? (YES)

3114 Dvr sta, indicator lights dimmable? (NO)

3116 Dvr sta, indicator lights, luminance range, (lx; ft-C)

3118 Dvr sta, instrument panel nomenclature used of appropriate size, contrast with panel, and readable? (YES)

3120 Dvr sta, decals/placards readable, properly placed? (YES)

3122 Dvr sta, controls provided best choice for critical driving tasks? (YES; USES LATERALS)

3124 Dvr sta, size, shape, spacing between controls appropriate for effective intended usage? (YES, GENERALLY; SEAT CONTROLS, NO)

3126 Dvr sta, controls located and arranged to facilitate sequential usage? (YES)

3128 Dvr sta, adequacy of access to driver's controls, rating scale 4 (5)

3130 Dvr sta, primary controls illuminated? (YES)

3132 Dvr sta, primary control area illumination level (lx; ft-C)

3134 Dvr sta, direction of control movement correct? (YES)

3136 Dvr sta, controls located adequately near associated displays? Rating scale 1 (5)

3138 Dvr sta, adequacy of driver control/display arrangement, rating scale 1 (5)

3139 Dvr sta, methods provided to reduce glare? (NO)

3140 Dvr sta, excessive force required to operate hand controls? (NO; EXCEPT SEAT CONTROLS)

3142 Dvr sta, force measurement of primary hand control (N; lbs)

3144 Dvr sta, force measurement of secondary hand control (N; lbs)

3146 Dvr sta, force measurement of tertiary hand control (N; lbs)

3148 Dvr sta, excessive force required to operate foot controls? (NO)

3150 Dvr sta, force measurement of excelerator (N; lbs)

3152 Dvr sta, force measurement of foot brake (N; lbs)

3154 Dvr sta, control switch guards, protective covers or guards provided? (YES; EXTERNAL SWITCH PANEL)

3156 Dvr sta, protective covers/guards, adequately positioned to permit observation of displays, nomenclature, indicators, etc., rating scale 1 (4)

3158 Dvr sta, steering device, adequacy of size to permit complete control of vehicle, rating scale 1 (5)

3160 Dvr sta, NBC collective protection provided? (YES)

3162 Dvr sta, NBC collective protection, hose located to provide ready access by driver, closed hatch operations, rating scale 3 (3)

3164 Dvr sta, NBC collective protection, air temp/humidity at mask (degrees, C; degrees, F; Rh)

3166 Dvr sta, NBC collective protection, access to collective protection filter cannister, rating scale 2 (1-6)

3168 Dvr sta, NBC collective protection, location of collective protection filter (REAR TURRET AREA)

3170 Dvr sta, type of NBC mask (text)

3172 Dvr sta, NBC, access to heater with collective protection, rating scale 2 (1-6)

3174 Dvr sta, NBC collective protection, air flow rate/volume at mask (ft/min; cu ft/min)

3176 Dvr sta, NBC collective protection, effectiveness of overpressure on driver tasks, rating scale 6 (1-6)

3177 Dvr sta, NBC collective protection, bulk air dump provided? (Yes/No; location)

3178 Dvr sta, NBC collective protection, bulk air dump rate/volume, (ft/min; cu ft/min)

3179 Dvr sta, NBC collective protection, effectiveness of NBC filter to strain dust, other non-NBC particulates, rating scale 6 (1-6)

3180 Dvr sta, adequacy of hatch entry padding, rating scale 2 (1)

3182 Dvr sta, ease of opening/closing hatch, rating scale 2 (4)

3183 Dvr sta, hatch dimensions, l x w x d, (15 X 21.25 IN.)

3184 Dvr sta, time to egress, from closed hatch position to outside of vehicle, non-NBC-clad, (seconds)

3186 Dvr sta, time to egress, from closed hatch position to outside of vehicle, NBC MOPP-4 clad, (seconds)

3188 Dvr sta, adequacy of hatch in size for 95th percentile arctic garbed male, rating scale 1 (4)

3190 Dvr sta, open hatch mode, probability of injury from traversing turret, rating scale 5 (2)

3192 Dvr sta, ease of transitioning from open to closed hatch mode with vehicle in motion, rating scale 2 (1-6)

3194 Dvr sta, time to transition from open to closed hatch mode with vehicle in motion, (seconds)

3196 Dvr sta, driver provided with daylight, closed hatch viewing system (DAY-CHV)? (YES)

3198 Dvr sta, closed hatch viewing, viewing distance to closest point in front of vehicle, using DAY-CHV, (m; ft)

3200 Dvr sta, general adequacy of closed hatch viewing to outside of vehicle, rating scale 1 (3)

3202 Dvr sta, closed hatch viewing, adequacy of interface with DAY-CHV device and NBC mask, rating scale 1 (1-6)

3204 Dvr sta, closed hatch, forward viewing angle through periscope from left to right, (APPROX 90 DEGREES)

3206 Dvr sta, closed hatch, forward viewing angle using DAY-CHV, from left to right, (degrees)

3208 Dvr sta, closed hatch, adequacy of upward viewing through DAY-CHV device, rating scale 1 (1-6)

3210 Dvr sta, closed hatch, adequacy of upward viewing through periscope, rating scale 1 (2)

3212 Dvr sta, closed hatch, upward viewing angle through DAY-CHV device, (degrees)

3214 Dvr sta, closed hatch, upward viewing angle through periscope, (APPROX 25 DEGREES)

3216 Dvr sta, DAY-CHV system, adequacy of defroster system, operation in cold weather, rating scale 1 (1-6)

3218 Dvr sta, DAY-CHV system, time to defrost, cold weather operations, from cold start (min, sec)

3220 Dvr sta, cold weather operations, frosting or misting of windshield/periscope? (YES - WIPER; NO - DEMISTING)

3222 Dvr sta, adequacy of wipers to remove rain, snow, dust, etc. from DAY-CHV, rating scale 1 (1-6)

3224 Dvr sta, night vision device provided? (Yes/No; comments)

3226 Dvr sta, adequacy of night vision device, rating scale 1 (1-6)

3228 Dvr sta, time to install driver night vision device from stowed position, (seconds)

3230 Dvr sta, visibility, adequacy of viewing ground, open hatch, seat adjusted fully up, 5th percentile male, rating scale 1 (5)

3232 Dvr sta, driver vision, open hatch, viewing distance to point on ground closed to vehicle, normally seated, 5th percentile male, seat adjusted fully up, (m; ft)

3234 Dvr sta, driver vision, open hatch, forward FOV, (degrees)

3236 Dvr sta, driver vision, open hatch, quality of forward, lateral visibility, rating scale 3 (5)

3238 Dvr sta, escape hatch provided other than primary hatch? (NO)

3240 Dvr sta, escape hatch dimensions, l x w, (mm, in.)

3242 Dvr sta, quality of accessibility to escape hatch, rating scale 3 (1-6)

3344 Dvr sta, location of communication (com) hookup, (RIGHT WALL, 7 IN. FROM HATCH ON UNDERSIDE OF CEILING)

3346 Dvr sta, ease of access to com hookup from normal seated position, rating scale 2 (5)

3348 Dvr sta, com equip, ease of operation of com box w/arctic handwear, rating scale 2 (5)

3350 Dvr sta, com equip, space between connector and bulkhead, or connector and closest object, (0.5 IN.)

3352 Dvr sta, speech intelligibility, dvr's com equip, CVC helmet, MRT, non-NBC, (percent correct)

3354 Dvr sta, speech intelligibility, dvr's com equip, CVC helmet, MRT, w/NBC mask, (percent correct)

3356 Dvr sta, com equip, probability of intercom cord interfering with dvr mobility, rating scale 7 (5)

3358 Dvr sta, effectiveness of communicating to other crew members using hand signals or other methods, rating scale 6 (2)

3360 Dvr sta, quality of speech intelligibility, dvr's com equip, CVC helmet, non-NBC, rating scale 2 (1-6)

3364 Dvr sta, quality of speech intelligibility, dvr's com equip, CVC helmet, w/NBC mask, rating scale 2 (1-6)

3370 Dvr sta, chance of handedness or eye glasses interfering with driving operations, rating scale 2 (3)

3372 Dvr sta, ease of training new operator quickly, rating scale 2 (4)

3376 Dvr's exterior lights, adjustable to illuminate desired field of view? (NO)

3378 Dvr's exterior lights, illumination level, 25m, full ON, front of vehicle, (lx; ft-C)

3380 Dvr's exterior lights, level of difficulty to replace bulbs, etc., rating scale 2 (5)

3382 Dvr sta, general adequacy of interior lighting, rating scale 1 (1-6)

3384 Dvr sta, accessibility of control for interior lighting, rating scale 4 (1-6)

3386 Dvr sta, safeguard provided against inadvertent activation of interior lights? (Yes/No; comments)

3390 Dvr sta, heater, temperature at dvr's feet, full ON, (degrees C; degrees F)

3392 Dvr sta, heater, variable heat control provided? (Yes/No;

comments)

3394 Dvr sta, heater, station designed for equal distribution of heat? (Yes/No; comments)

3396 Dvr sta, ease of operation considering practicality of heater, reliability, accessibility, etc., rating scale 2 (1-6)

3398 Dvr sta, heater, accessibility of heater control, rating scale 4 (1-6)

3400 Dvr sta, heater, adequacy of safeguards to prevent heat injury to personnel, rating scale 1 (1-6)

3408 Dvr sta, ventilation, non-NBC; air flow rate/volume at station, (ft/min; cu ft/min)

3410 Dvr sta, ventilation, non-NBC; proportion fresh outside air provided to station, (percent)

3412 Dvr sta, ventilation, non-NBC; variable control provided for ventilation system? (Yes/No; comments)

3414 Dvr sta, ventilation, non-NBC; accessibility to ventilation control, rating scale 4 (1-6)

3416 Dvr sta, ventilation, non-NBC; effectiveness of ventilation system at station, 6 (1-6)

3456 Dvr sta, steady-state noise hazards, any frequency/condition, rating scale 5 (1-6)

3460 Dvr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 125 HZ, (dBA)

3464 Dvr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 500 HZ, (dBA)

3468 Dvr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 2000 HZ, (dBA)

3470 Dvr sta, impulse noise hazards, main gun/coax, rating scale 5 (1-6)

3472 Dvr sta, impulse noise, main gun firing, closed hatch, gun pos forward, (A duration; B duration: peak pressure-dBA)

3480 Dvr sta, seat vibration, prob of degrading task performance, rating scale 7 (1-6)

3482 Dvr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, X-axis, (RMS, 30 HZ; 50 HZ; 80)

3484 Dvr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Y-axis, (RMS, 30 HZ; 50 HZ; 80 HZ)

3486 Dvr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Z-axis, (RMS 30 HZ; 50 HZ; 80 HZ)

3488 Dvr sta, probability of ride vibrations causing visual difficulties, rating scale 7 (1-6)

3490 Dvr sta, vibration amplitude, dvr's instrument panel, (RMS)

3494 Dvr sta, vehicle lurch, start-stop? (Yes/No; comments)

3500 Dvr sta, emergency brake, location (MOUNTED ON FLOOR TO LEFT OF DVR)

3502 Dvr sta, emergency brake, type of actuation (PULL-UP HANDLE)

3504 Dvr sta, emergency brake, force required, operation, (N; lbs)

3506 Dvr sta, general anthropometric fit, [percentile male]

Human Factors Engineering Data Base
File Name: AMR3
Commander's Station

4000 Cmdr sta, seat back dimensions, l x w, (10 X 11 IN.)

4001 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, dimensions seat pan, l x w, (14.5 X 15 IN.)

4002 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, seat padding thickness (2 IN.)

4004 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, back-rest-to-seat angle, (90 DEGREES NON-ADJUSTABLE)

4006 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, seat slope, (90 DEGREES NON-ADJUSTABLE)

4008 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, distance from seat front, top of padding, to floor, (ADJUSTED FULLY UP = 22 IN.; ADJUSTED FULLY DOWN = 12 IN.)

4010 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, vertical adjustability, (6 IN.)

4012 Cmdr sta, seat, IAW MIL-STD-1472C, Fig 50, forward adjustability, (range in mm; in.)

4014 Cmdr sta, seat pan material, (VINYL)

4016 Cmdr sta, seat back material, (VINYL)

4018 Cmdr sta, seat, head rest material, (text)

4020 Cmdr sta, seat, restraint system provided? (Yes/No; comments)

4021 Cmdr sta, adequacy of restraint system, rating scale 1 (1-6)

4022 Cmdr sta, seat, MIL-STD-1472C, Table 28 dimension A, Elbow, dynamic, (29 IN. ADJUSTED DOWN; 23 IN. ADJUSTED UP)

4024 Cmdr sta, seat, MIL-STD-1472C, Table 28 dimension B, Elbow, static, (26 IN. ADJUSTED DOWN; 19 IN. ADJUSTED UP)

4026 Cmdr sta, seat, MIL-STD-1472C, Table 28 dimension C, Shoulder, (19 IN. ADJUSTED DOWN; 20 IN. ADJUSTED UP)

4028 Cmdr sta, seat, MIL-STD-1472C, Table 28 dimension D, Knee width, minimum, (18 IN.)

4030 Cmdr sta, seat, MIL-STD-1472C, Table 28 dimension E, Knee

width, maximum, (22 IN.)

4032 Cmdr sta, seat, MIL-STD-1472C, Table 28 measurement 1, closed hatch, SRP to underside of hatch, (38.25 IN.)

4034 Cmdr sta, seat, MIL-STD-1472C, Table 28 measurement 2, Abdominal, seat back to nearest forward object, (28.75 IN.)

4036 Cmdr sta, seat, MIL-STD-1472C, Table 28 measurement 4, Seat depth SRP to front edge of seat pan, (9.5 IN.)

4040 Cmdr sta, seat, MIL-STD-1472C, Table 28 measurement 7, Boot, front seat pan to nearest object forward, (11 IN.)

4042 Cmdr Sta, seat, effectiveness of cmdr's seat, considering adjustability, cushioning, size, and back angle, rating scale 6 (5)

4044 Cmdr sta, seat adjustable vertically? (YES; HYDRAULICALLY ACTUATED)

4046 Cmdr sta, quality of viewing cmdr's instruments with seat adjusted fully up, open hatch, for 95th percentile male, rating scale 3 (4)

4048 Cmdr sta, quality of viewing cmdr's instruments during closed hatch operations, rating scale 3 (4)

4050 Cmdr sta, adequacy of lumbar (back) support during extended operations, rating scale 1 (4)

4052 Cmdr sta, seat material promote excessive perspiration during extended operations? (YES; PROBABLY)

4054 Cmdr sta, foot rest provided for arctic boot-sized foot? (NO; USES FLOOR)

4056 Cmdr sta, adequacy of foot rest for operations in closed hatch seated condition, rating scale 1 (4)

4058 Cmdr sta, foot rest dimensions, l x w, (11 X 18.5 IN.)

4060 Cmdr sta, vertically-adjustable standing platform provided for stand-up, open hatch operations? (NO)

4062 Cmdr sta, adequacy of standing platform considering use with arctic boots, rating scale 1 (1-6)

4064 Cmdr sta, can cmdr's seat be adjusted to permit sitting with head and shoulders exposed? (YES; SEAT BACK FOLDS UP AND OUT FOR SEATED OPEN HATCH USE)

4066 Cmdr sta, approx distance 95th percentile seated male exposed above hatch line, seat adjusted fully up, (11 IN.)

4068 Cmdr sta, ease of emergency egress, open hatch, non-NBC clad 95th percentile male, rating scale 2 (5)

4070 Cmdr sta, ease of emergency egress, open hatch, NBC MOPP-4 clad 95th percentile male, rating scale 2 (5)

4072 Cmdr sta, average time to emergency egress from cmdr sta, open hatch, non-NBC clad 95th percentile male, (no. trials; seconds)

4074 Cmdr sta, average time to emergency egress from cmdr sta, open hatch, NBC MOPP-4 clad 95th percentile male, (seconds)

4076 Cmdr sta, seat, capability to fold seat back for stand-up operations? (YES; USES SEAT PAN FOR STAND-UP OPEN HATCH OPS)

4078 Cmdr sta, ease of folding seat back for stand-up operations, rating scale 2 (4)

4080 Cmdr sta, ease of access to adjustment controls for seat operation, rating scale 2 (4)

4082 Cmdr sta, force required to operate seat adjustment controls, (N; lbs)

4084 Cmdr sta, probability of injury during the performance of dynamic tasks (transitioning from open to closed hatch, etc.), due to contact with station equipment, rating scale 5 (3)

4086 Cmdr sta, quality of viewing all controls and displays during day/night closed/open hatch operations, rating scale 3 (5)

4088 Cmdr sta, effectiveness of cupola periscopes for outside viewing during closed hatch operations, rating scale 6 (4)

4090 Cmdr sta, cupola provided with controls for manual traverse (of cupola)? (YES; ALSO PROVIDED WITH LOCK-DOWN DEVICE)

4091 Cmdr sta, ease of locking/unlocking cupola manual traverse locking device, rating scale 2 (5)

4092 Cmdr sta, force required to unlock cupola traverse lock, (N; lbs)

4093 Cmdr sta, force required to actuate manual cupola traverse control, (N; lbs)

4094 Cmdr sta, level of difficulty to rotate cupola using manual controls, rating scale 2 (5)

4096 Cmdr sta, weapons servicing, ease of sighting and firing cmdr's weapon, closed hatch, considering rotation of cupola, location of periscopes, and fire controls, rating scale 2 (1-6)

4098 Cmdr sta, ease of sighting and firing cmdr's weapon, open hatch mode, rating scale 2 (1-6)

4100 Cmdr sta, average time to charge and sight cmdr's weapon frcm seated position, open hatch, (no. trials; seconds)

4102 Cmdr sta, ease of access to ammunition for cmdr's weapon, rating scale 2 (1-6)

4104 Cmdr sta, average time to upload (from ammo stowage), reload cmdr's weapon, (no. trials; seconds)

4106 Cmdr sta, ease of uploading/reloading tasks, cmdr's weapon, rating scale 2 (1-6)

4108 Cmdr sta, ease of performing simple maintenance or repairs on cmdr's weapon, rating scale 2 (1-6)

4110 Cmdr sta, average time to acquire target using cmdr's GPS extension, open hatch mode, non-NBC, daytime, (no. trials; range in meters; seconds)

4120 Cmdr sta, average time to acquire target using cmdr's GPS extension, open hatch mode, NBC MOPP-4, daytime, (no. trials; range in meters; seconds)

4122 Cmdr sta, average time to acquire target using cmdr's GPS extension, closed hatch, non-NBC, (no. trials; range in meters; seconds)

4124 Cmdr sta, average time to acquire target using cmdr's GPS extension, closed hatch, NBC MOPP-4, (no. trials; range in meters; seconds)

4126 Cmdr sta, ease of performing target acquisition and main gun firing tasks using cmdr's GPS extension, open hatch, rating scale 2 (1-6)

4128 Cmdr sta, ease of performing target acquisition and main gun firing tasks using cmdr's GPS extension, closed hatch, rating scale 2 (1-6)

4138 Cmdr sta, com equip, location of com hookup (TURRET WALL TO RIGHT OF SEATED CMDR)

4140 Cmdr sta, ease of operation of com box w/arctic handwear, rating scale 2 (3)

4142 Cmdr sta, quality of speech intelligibility, cmdr's com equip, CVC helmet, non-NBC, rating scale 2 (1-6)

4143 Cmdr sta, quality of speech intelligibility, cmdr's com equip, CVC helmet, w/NBC mask, rating scale 2 (1-6)

4144 Cmdr sta, speech intelligibility, cmdr's com equip, CVC helmet, non-NBC, MRT, (percent correct)

4145 Cmdr sta, speech intelligibility, cmdr's com equip, CVC helmet, w/NBC mask, MRT, (percent correct)

4146 Cmdr sta, com equip, space between connector and bulkhead or nearest object, (0.25 IN.)

4147 Cmdr sta, effectiveness of communicating with other crew members using hand signals or other non-electronic methods, rating scale 6 (5)

4148 Cmdr sta, overall adequacy of controls/displays for tasks cmdr must perform, rating scale 1 (5)

4149 Cmdr sta, accessibility for operation of controls, rating scale 4 (5)

4150 Cmdr sta, quality of visibility of controls/displays, day and nighttime operations, rating scale 3 (5)

4152 Cmdr sta, distance from design eye, to nearest display, (8 IN.)

4154 Cmdr sta, distance from design eye, to most distant display, (23 IN.)

4156 Cmdr sta, viewing angle from design eye position to worse case primary display, (degrees)

4158 Cmdr sta, display functions grouped together? (YES)

4160 Cmdr sta, closed hatch, displays readable? (YES)

4162 Cmdr sta, displays illuminated? (Yes/No; comments)

4163 Cmdr sta, primary display; color (WHITE ON BLACK)

4164 Cmdr sta, secondary display; (color)

4165 Cmdr sta, controls provided with display for variable lumination? (NO)

4166 Cmdr sta, master power control provided? (YES)

4167 Cmdr sta, range of display luminance, (display description; range in lx; ft-L)

4168 Cmdr sta, displays color-coded efficiently IAW MIL-STD-1472C? (YES)

4170 Cmdr sta, indicator lights grouped together, close to cmdr's line of sight? (Yes/No; NONE PROVIDED)

4174 Cmdr sta, indicator lights color-coded IAW MIL-STD-1472C? (Yes/No; comments)

4176 Cmdr sta, indicator lights testable? (Yes/No; comments)

4178 Cmdr sta, indicator lights dimmable? (Yes/No; comments)

4180 Cmdr sta, range of luminance for indicator lights, (indicator light description; range in lx; ft-L)

4182 Cmdr sta, direction of control movement for all controls IAW MIL-STD-1472C? (YES)

4184 Cmdr sta, for instrument panels, indicators, displays/controls, nomenclature used of appropriate size, contrast with background, and readable? (YES)

4186 Cmdr sta, decals/placards readable, understandable, properly placed? (YES; EXCEPT SMOKE GRENADE LAUNCHER BOX PANEL)

4188 Cmdr sta, general, ease of control actuation for all cmdr's controls, rating scale 2 (5)

4190 Cmdr sta, force required, worse case, control actuation, (N; lbs)

4192 Cmdr sta, protective covers or guards placed over controls or switches where appropriate? (YES)

4194 Cmdr sta, NBC collective protection provided? (YES; OVERPRESSURE AND FORCED AIR DUCT SYSTEM)

4196 Cmdr sta, NBC collective protection, location of hose to provide ready access by cmdr, closed hatch operations, rating scale 1 (2)

4197 Cmdr sta, location of interface point w/which to hook hose of individual NBC suit into collective protection system, (VENTILATION PORTS TO RIGHT SHOULDER AREA; HOSE ATTACHMENT POINT ON SIDE OF VENT BOX)

4198 Cmdr sta, NBC collective protection, air temp/humidity at mask, full cooling (ambient outside temp/humidity; temp/humid measured at mask, degrees, C; degrees, F: Rh)

4200 Cmdr sta, type of NBC mask (text)

4202 Cmdr sta, NBC collective protection, air flow rate/volume at mask (ft/min; cu ft/min)

4204 Cmdr sta, general adequacy of NBC collective protective system, rating scale 1 (1-6)

4208 Cmdr sta, NBC collective protection, effectiveness of overpressure at cmdr's station, rating scale 6 (1-6)

4210 Cmdr sta, NBC collective protection, effectiveness of filtration system to strain dust, other non-NBC particulates from outside, rating scale 6 (1-6)

4230 Cmdr sta, hatch, adequacy of hatch entry padding, rating scale 1 (3)

4232 Cmdr sta, hatch, ease of opening/closing hatch from inside vehicle, rating scale 2 (5)

4234 Cmdr sta, time to egress, from closed hatch position to outside of vehicle, non-NBC clad, (seconds)

4236 Cmdr sta, time to egress, from closed hatch position to outside of vehicle, NBC MOPP-4 clad, (seconds)

4238 Cmdr sta, adequacy of hatch in size for 95th percentile arctic garbed male, rating scale 1 (5)

4240 Cmdr sta, hatch dimensions, l x w x d, (20 IN. DIA.)

4242 Cmdr sta, hatch, combat lock provided? (YES)

4244 Cmdr sta, force required to unlock combat lock, (N; lbs)

4246 Cmdr sta, ease of transitioning from open to closed hatch, rating scale 2 (4)

4248 Cmdr sta, time to transition from open to closed hatch mode (seconds)

4250 Cmdr sta, hatch provide a partially open ("pop-up") mode to allow unrestricted observation while maintaining overhead cover? (NO; TWO PIECE CLAM SHELL HATCH)

4252 Cmdr sta, space provided between top of turret and bottom of hatch lip in 'pop-up' mode, (mm; in.)

4254 Cmdr sta, hatch make contact with any other equipment of vehicle when open or partially open? (e.g., strike loader's hatch, antenna mount, etc), (NO)

4256 Cmdr sta, outside viewing, closed hatch using periscopes/vision blocks, (0 to 360 degrees)

4258 Cmdr sta, outside viewing, closed hatch, blind spots? (NO)

4260 Cmdr sta, outside viewing, closed hatch, upward viewing angle through periscopes/vision blocks, (degrees)

4262 Cmdr sta, adequacy of outside viewing, closed hatch, through periscopes/vision blocks for target acquisition and surveillance, rating scale 1 (4)

4264 Cmdr sta, cmdr's weapon periscope, adequacy of viewing to effectively engage targets using cmdr's weapon, rating scale 1 (1-6)

4266 Cmdr sta, means provided to clear closed hatch vision systems of frost, dust, mud, etc. without exiting vehicle? (YES; WIPERS)

4268 Cmdr sta, adequacy of means provided to clear vision systems of frost, etc. without exiting vehicle, rating scale 1 (1-6)

4270 Cmdr sta, night vision device available for viewing through periscopes/vision blocks? (YES; IR)

4274 Cmdr sta, effectiveness of night vision device for target acquisition, surveillance, engagement, rating scale 6 (1-6)

4280 Cmdr sta, illumination levels, open hatch, measured at communications device and instrument panels, (lx; ft-C)

4282 Cmdr sta, illumination levels, closed hatch, measured at communications device and instrument panels, (lx; ft-C)

4284 Cmdr sta, luminance levels of displays, (type of display; location; lx; ft-L)

4286 Cmdr sta, chance of handedness or eye glasses interfering with operations, rating scale 3 (3)

4288 Cmdr sta, general adequacy of interior lighting, rating scale 1 (1-6)

4290 Cmdr sta, accessibility of controls for internal lighting, rating scale 4 (4)

4292 Cmdr sta, safeguard provided against inadvertent activation of interior lights? (NO)

4294 Cmdr sta, heater, temperature at cmdr's station, (degrees C; degrees F)

4296 Cmdr sta, heater, station designed for equal distribution of heat? (Yes/No; comments)

4300 Cmdr sta, ventilation, non-NBC; air flow rate/volume at station, (ft/min; cu ft/min)

4304 Cmdr sta, ventilation, non-NBC; proportion fresh outside air provided to station, (percent)

4306 Cmdr sta, ventilation, non-NBC; variable control provided for ventilation system? (NO; VENT AIR DIRECTION CONTROLLABLE)

4308 Cmdr sta, ventilation, non-NBC; variable control for ventilation provided for all stations at cmdr's sta? Yes/No; comments)

4310 Cmdr sta, ventilation, non-NBC; accessibility to ventilation control, rating scale 4 (1-6)

4312 Cmdr sta, ventilation, non-NBC; effectiveness of ventilation system at station, rating scale 6 (1-6)

4318 Cmdr sta, steady-state noise hazards, any frequency/conditions, rating scale 5 (1-6)

4320 Cmdr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 125 HZ, (dBA)

4324 Cmdr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 500 HZ, (dBA)

4328 Cmdr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 2000 HZ (dBA)

4330 Cmdr sta, impulse noise hazards, main gun/coax, rating scale 5 (1-6)

4332 Cmdr sta, impulse noise, main gun firing, closed hatch, gun pos forward, (A duration; B duration; peak pressure-dBA)

4340 Cmdr sta, seat vibration, prob of degrading task performance, rating scale 7 (1-6)

4342 Cmdr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, X-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

4344 Cmdr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Y-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

4346 Cmdr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Z-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

4348 Cmdr sta, probability of ride vibrations causing visual

difficulties for cmdr, rating scale 7 (1-6)

4350 Cmdr sta, vibration amplitude, cmdr's console, (RMS)

4352 Cmdr sta, general anthropometric fit, [percentile male]

Human Factors Engineering Data Base
File Name: AMR4
Gunner's Station

5000 Gun sta, seat back dimensions, l x w, (5.5 x 11 IN.)

5001 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, seat pan dimensions, l x w, (12 x 14.5 IN.)

5004 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, seat padding thickness, (2.5 IN.)

5006 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, back-rest-to-seat angle, (degrees)

5008 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, seat slope, (degrees)

5010 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, distance from seat front, top of padding, to floor, (18 IN. FULLY DOWN; 22 IN. UP)

5012 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, vertical adjustability, (4 IN.)

5014 Gun sta, seat, IAW MIL-STD-1472C, Fig 50, forward-rearward adjustability, (NONE)

5016 Gun sta, seat, seat pan material, (VINYL)

5018 Gun sta, seat, seat back material, (VINYL)

5020 Gun sta, seat, head rest material, (NONE)

5022 Gun sta, seat, restraint system provided? (NO)

5023 Gun sta, adequacy of restraint system, rating scale 1 (1-6)

5024 Gun sta, seat, MIL-STD-1472C, Table 28 dimension A, Elbow, dynamic, (28 IN.)

5026 Gun sta, seat, MIL-STD-1472C, Table 28 dimension B, Elbow, static, (26 IN.)

5028 Gun sta, seat, MIL-STD-1472C, Table 28 dimension C, Shoulder, (27.5 IN.)

5030 Gun sta, seat, MIL-STD-1472C, Table 28 dimension D, Knee width, minimum, (13 IN.)

5032 Gun sta, seat, MIL-STD-1472C, Table 28 dimension E, Knee width, maximum, (16 IN.)

5034 Gun sta, seat, MIL-STD-1472C, Table 28 measurement 1, SRP to closest object overhead, (39 IN.)

5036 Gun sta, seat, MIL-STD-1472C, Table 28 measurement 2, Abdominal, seat back to nearest forward object, (16 IN.)

5038 Gun sta, seat, MIL-STD-1472C, Table 28 measurement 4, seat depth SRP to front edge of seat pan, (8 IN.)

5040 Gun sta, seat, MIL-STD-1472C, Table 28 measurement 6, seat pan height, (15 IN.)

5042 Gun sta, seat, MIL-STD-1472C, Table 28 measurement 7, boot, front of seat pan to nearest object forward, (15.5 IN.)

5044 Gun sta, seat, effectiveness of gunner's seat, considering adjustability, cushioning, size, and back angle, rating scale 4 (4)

5046 Gun sta, seat, adjustable vertically? (YES)

5048 Gun sta, instruments, overall quality of viewing during closed hatch operations, rating scale 3 (5)

5050 Gun sta, adequacy of lumbar (back) support during cross country maneuvers, rating scale 1 (3)

5052 Gun sta, seat material promote excessive perspiration during extended operations? (YES)

5054 Gun sta, protective guard provided between leg and gun breech? (YES)

5056 Gun sta, ease of emergency egress, non-NBC, 95th percentile male, rating scale 2 (4)

5058 Gun sta, ease of emergency egress, NBC MOPP-4, 95th percentile male, rating scale 2 (4)

5060 Gun sta, average time to emergency egress from sta, non-NBC, 95th percentile male, (no. trials; seconds)

5062 Gun sta, average time to emergency egress from sta, NBC MOPP-4, 95th percentile male, (no. trials; seconds)

5064 Gun sta, ease of access to adjustment controls for seat operation, rating scale 2 (4)

5066 Gun sta, force required to operate seat adjustment controls, (N; lbs)

5068 Gun sta, quality of viewing all controls and displays, rating scale 3 (5)

5070 Gun sta, seat designed to laterally restrain gunner during violent maneuvers? (YES; SEAT RECESSED APPROX 3 INCHES IN DEPTH BETWEEN THE TURRET RING COVER AND PROTECTIVE BARRIER BETWEEN GNR AND BREECH)

5072 Gun sta, seat designed so forward edge prevents restricted blood flow in popliteal (underside) of leg? (NO)

5074 Gun sta, retractable chest support provided? (NO)

5076 Gun sta, adequacy of retractable chest support to steady gunner during gunnery operations, rating scale 1 (1-6)

5078 Gun sta, dimensions of chest support, l x w x d, (mm; in.)

5100 Gun sta, adequacy of workspace to perform powered target acquisition and tracking, rating scale 1 (1-6)

5104 Gun sta, adequacy of workspace to perform powered gun lay, rating scale 1 (1-6)

5106 Gun sta, average time to acquire targets using GPS, powered mode, (no. trials; range of target in meters; seconds)

5110 Gun sta, adequacy of workspace to perform manual target acquisition and tracking, rating scale 1 (1-4)

5112 Gun sta, adequacy of workspace to perform manual gun lay, rating scale 1 (5)

5116 Gun sta, average time to acquire target, manual mode, (no. trials; range of target; seconds)

5118 Gun sta, average time to lay on target, manual mode, (no. trials; range of target; seconds)

5120 Gun sta, ease of selecting designated ammunition type during main gun firing, rating scale 2 (1-6)

5122 Gun sta, effectiveness of range finder during firing procedures, rating scale 6 (1-6)

5126 Gun sta, ease of selection of coax or main weapon as desired, rating scale 2 (5)

5127 Gun sta, accessibility of main gun/coax selector, rating scale 4 (5)

5128 Gun sta, controls, distance from SRP to nearest control, (13 IN.)

5130 Gun sta, controls, distance from SRP to most distant control, (24 IN.)

5134 Gun sta, accessibility for operation of all controls, rating scale 4 (5)

5136 Gun sta, quality of visual access to all controls and displays, day and night operations, rating scale 3 (4)

5150 Gun sta, location of communications equipment, (RIGHT OF GNR STA, 12 IN. FROM DESIGN EYE)

5152 Gun sta, ease of operation of com box w/arctic handwear, rating scale 2 (4)

5153 Gun sta, com equip, space between connector and bulkhead or nearest object, (.75 IN.)

5154 Gun sta, speech intelligibility, gnr's com equip, CVC helmet, MRT, non-NBC, (percent correct)

5155 Gun sta, speech intellibibility, gnr's com equip, CVC helmet, MRT, w/NBC mask, (percent correct)

5156 Gun sta, quality of speech intelligibility, gnr's com equip, CVC helmet, non-NBC, rating scale 2 (1-6)

5157 Gun sta, quality of speech intelligibility, gnr's com equip, CVC helmet, w/NBC mask, rating scale 2 (1-6)

5158 Gun sta, effectiveness of communicating with other crew members using hand signals or other non-electronic methods, rating scale 6 (5)

5159 Gun sta, overall adequacy of controls/displays for critical gunnery tasks, 1 (4)

5160 Gun sta, controls/displays arranged for optimum usage? (YES)

5162 Gun sta, controls/displays; size, shape, spacing appropriate for intended usage? (YES)

5164 Gun sta, similar controls/displays grouped for sequential usage? (YES)

5165 Gun sta, direction of control movement for all controls correct IAW MIL-STD-1472C? (YES)

5166 Gun sta, viewing angle from design eye position to worse case primary display, (degrees)

5167 Gun sta, adequacy of control/display illumination, rating scale 1 (1-6)

5168 Gun sta, illumination level, open hatch, measured at

primary display/control position, (lx; ft-C)

5169 Gun sta, illumination level, closed hatch, measured at primary display/control position, (lx; ft-C)

5171 Gun sta, adequacy of control/display luminance, rating scale 1 (1-6)

5172 Gun sta, displays color-coded efficiently, IAW MIL-STD-1472C? (YES)

5174 Gun sta, display color coding, primary display, (RED, GREEN ON WHITE BACKGRND)

5176 Gun sta, display color coding, secondary display, (red, blue-green, white, etc.)

5178 Gun sta, variable luminance control provided with primary display? (NO)

5179 Gun sta, variable luminance control provided with secondary display? (Yes/No; comments)

5182 Gun sta, range of display luminance, primary display, (display description; range in lx; ft-L)

5184 Gun sta, indicator lights grouped together, close to gunner's line of sight? (YES)

5186 Gun sta, indicator lights correctly color-coded IAW MIL-STD-1472C? (YES)

5190 Gun sta, indicator lights testable? (NO)

5192 Gun sta, indicator lights dimmable? (NO)

5194 Gun sta, range of luminance for indicator lights, primary warning light, (warning light description; range in lx; ft-L)

5196 Gun sta, range of luminance for indicator lights, secondary warning or caution light, (indicator light description; range in lx; ft-L)

5198 Gun sta, adequacy of luminance for primary, warning indicator light, rating scale 1 (1-6)

5200 Gun sta, adequacy of luminance for secondary, warning or caution indicator light, rating scale 1 (1-6)

5202 Gun sta, for instrument panels, indicators, displays/controls, nomenclature used of appropriate size, contrast with background, and readable? (YES; EXCEPT LABELING ON LIGHT CONTROL BOX)

5204 Gun sta, decals/placards readable, readily understood, and properly placed? (Yes/No; comments)

5206 Gun sta, ease of control actuation for all gunner's controls, rating scale 2 (4)

5208 Gun sta, force required, worse case, control actuation, (N; lbs)

5214 Gun sta, protective covers/guards placed over controls or switches where appropriate (YES; EXCEPT COAX/MAIN SWITCH)

5216 Gun sta, NBC collective protection provided? (YES)

5218 Gun sta, if NBC collective protection not provided, describe system, (text)

5220 Gun sta, NBC collective protection, location of interface point with which to hook into hose of individual vest/NBC suit, (FRONT OF FIRE CONTROL HANDLE/AZIMUTH INDICATOR; HOSE, WHEN ENGAGED WITH VENT BOX COULD INTERFERE WITH MOVEMENT OF FIRE CONTROL HANDLE)

5222 Gun sta, NBC collective protection, air temp/humidity at mask, full cooling (ambient outside temp/humidity; temp/humid measured at mask, degrees, C; degrees, F; Rh)

5224 Gun sta, NBC, type of mask, (text)

5226 Gun sta, NBC collective protection, air flow rate/volume at mask (ft/min; cu ft/min)

5228 Gun sta, general adequacy of NBC collective protection, (mask and vest, bulk dump, etc.), rating scale 1 (1-6)

5230 Gun sta, NBC collective protection, effectiveness of overpressure, rating scale 6 (1-6)

5232 Gun sta, NBC, effectiveness of NBC system to strain dust, other non-NBC particulates from outside, rating scale 6 (1-6)

5240 Gun sta, hatch provided? (NO)

5242 Gun sta, hatch, ease of opening/closing from inside vehicle, rating scale 2 (1-6)

5246 Gun sta, time to egress, from closed hatch position to outside of vehicle, non-NBC clad, (seconds)

5248 Gun sta, time to egress, from closed hatch position to outside of vehicle, NBC MOPP-4 clad, (seconds)

5252 Gun sta, adequacy of hatch in size for 95th percentile arctic garbed male, rating scale 1 (1-6)

5254 Gun sta, hatch dimensions, l x w x d, (mm; in.)

5456 Gun sta, hatch, combat lock provided? (Yes/No; comments)

5458 Gun sta, force required to unlock combat lock, (N; lbs)

5460 Gun sta, effectiveness of gunner's unity periscope/vision block for surveillance/initial target acquisition, without NBC mask, rating scale 6 (4)

5462 Gun sta, effectiveness of gunner's unity periscope/vision block for surveillance/initial target acquisition, with NBC mask, rating scale 6 (1-6)

5466 Gun sta, quality of vision through GPS, day mode, rating scale 3 (1-6)

5468 Gun sta, quality of vision through GPS, night mode, rating scale 3 (1-6)

5470 Gun sta, quality of vision through auxiliary sight, day mode, rating scale 3 (1-6)

5472 Gun sta, quality of vision through auxiliary sight, night mode, rating scale 3 (1-6)

5476 Gun sta, average overall time to engage target (target acquisition, tracking, first round fire), moving target, stationary tank, non-NBC, (no. trials; target range, target speed; seconds)

5478 Gun sta, average overall time to engage target (target acquisition, tracking, first round fire), moving target, stationary tank, NBC MOPP-4, (no. trials; target range, target speed; seconds)

5480 Gun sta, average overall time to engage target (target acquisition, tracking, first round fire), stationary target, stationary tank, non-NBC, (no. trials; target range; seconds)

5482 Gun sta, average overall time to engage target (target acquisition, tracking, first round fire), stationary target, stationary tank, NBC MOPP-4, (no. trials; target range; seconds)

5484 Gun sta, average overall time to engage target (target acquisition, tracking, first round fire), stationary target, moving tank, non-NBC, (no. trials; target range; seconds)

5486 Gun sta, average overall time to engage target (target acquisition, tracking, first round fire), stationary target, moving tank, NBC MOPP-4, (no. trials; target range; seconds)

5490 Gun sta, chance of handedness or eye glasses interfering with operations, rating scale 3 (3)

5492 Gun sta, ease of training new operator quickly, rating scale 2 (4)

5494 Gun sta, general adequacy of interor lighing, rating scale 1 (1-6)

5496 Gun sta, accessibility of controls for internal lighting, rating scale 4 (5)

5498 Gun sta, safeguard provided against inadvertent activation of interior lights? (YES; SIMPLE BARRIERS)

5500 Gun sta, heater, temperature at gnr's sta, (degrees C; degrees F)

5502 Gun sta, heater, station designed for equal distribution of heat? (Yes/No; comments)

5510 Gun sta, ventilation, non-NBC; effectiveness of fresh air ventilation system, rating scale 6 (1-6)

5512 Gun sta, ventilation, non-NBC; air flow rate/volume at station, (ft/min; cu ft/min)

5514 Gun sta, ventilation, non-NBC; proportion fresh outside air provided to station, (percent)

5516 Gun sta, ventilation, non-NBC; variable control provided for ventilation system? (Yes/No; comments)

5518 Gun sta, ventilation, non-NBC; accessibility to ventilation control, rating scale 4 (1-6)

5528 Gun sta, steady-state noise hazards, any frequency/condition, rating scale 5 (1-6)

5530 Gun sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 125 HZ, (dBA)

5534 Gun sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 500 HZ, (dBA)

5538 Gun sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 2000 HZ, (dBA)

5540 Gun sta, impulse noise hazards, main gun/coax, rating scale

5 (1-6)

5542 Gun sta, impulse noise, main gun firing, closed hatch, gun pos forward, (A duration; B duration; peak pressure-dBA)

5550 Gun sta, seat vibration, prob of degrading task performance, rating scale 7 (1-6)

5552 Gun sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, X-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

5554 Gun sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Y-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

5556 Gun sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Z-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

5558 Gun sta, probability of ride vibration causing visual difficulties for gunner, rating scale 7 (1-6)

5560 Gun sta, acceleration, gunner's primary sight optic, (G-acceleration)

5562 Gun sta, acceleration, gunner's brow pad, (G-acceleration)

5564 Gun sta, accelaration, gunner's chest pad, (G-acceleration)

5566 Gun sta, effectiveness of manual data entry into ballistic fire control system under combat; consider ammunition selection, range data, etc., rating scale 6 (1-6)

5580 Gun sta, target acquisition, periscope, location (LEFT OF GNR, 3 IN. FROM DESIGN EYE)

5584 Gun sta, target acquisition, periscope, model (SIGHT PERISCOPE NO. 59; MONOCULAR SIGHT PERISCOPE NO. 26 MK 1)

5586 Gun sta, target acquisition, periscope, magnification (X 1, X 7, X 8 POWER)

5588 Gun sta, target acquisition, periscope, horizontel field of view, (degrees)

5592 Gun sta, target acquisition, periscope, vertical field of view, (degrees)

5594 Gun sta, target acquisition, periscope, range (meters)

5596 Gun sta, target acquisition, periscope, limitations (text)

5598 Gun sta, general anthropometric fit, [percentile male]

Human Factors Engineering Data Base
File Name: AMR5
Loader's Station

6000 Ldr sta, seat back dimensions, l x w (mm; in.)

6001 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, seat pan dimensions, l x w, (mm; in.)

6004 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, seat padding thickness, (mm; in.)

6006 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, back-rest-to-seat angle, (degrees)

6008 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, seat slope, (degrees)

6010 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, distance from seat front, top of padding, to floor, (mm; in.)

6012 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, vertical adjustability, (range in mm: in.)

6014 Ldr sta, seat, IAW MIL-STD-1472C, Fig 50, forward-rearward adjustability, (range in mm; in.)

6016 Ldr sta, seat, seat pan material, (text)

6018 Ldr sta, seat, seat back material, (text)

6020 Ldr sta, seat, restraint system provided (Yes/No/ comments)

6022 Ldr sta, seat, adequacy of restraint system with vehicle in motion, rating scale 1 (1-6)

6030 Ldr sta, seat, MIL-STD-1472C, Table 28 dimension A, Elbow, dynamic, (mm; in.)

6034 Ldr sta, seat, MIL-STD-1472C, Table 28 dimension B, Elbow, static, (mm; in.)

6036 Ldr sta, seat, MIL-STD-1472C, Table 28 dimension C, Shoulder, (mm; in.)

6038 Ldr sta, seat, MIL-STD-1472C, Table 28 dimension D, Knee width, minimum, (mm; in.)

6040 Ldr sta, seat, MIL-STD-1472C, Table 28 dimension E, Knee width, maximum, (mm; in.)

6042 Ldr sta, seat, MIL-STD-1472C, Table 28 measurement 1,

closed hatch, SRP to underside of hatch, seat adjusted fully down, (mm; in.)

6044 Ldr sta, seat, MIL-STD-1472C, Table 28 measurement 2, abdominal, seat back to nearest forward object, (mm; in.)

6046 Ldr sta, seat, MIL-STD-1472C, Table 28 measurement 4, seat depth, SRP to front edge of seat pan, (mm; in.)

6048 Ldr sta, seat, MIL-STD-1472C, Table 28 measurement 6, seat pan height, (mm; in.)

6054 Ldr sta, seat, MIL-STD-1472C, Table 28 measurement 7, boot, front of seat pan to nearest object forward, (mm; in.)

6056 Ldr sta, seat, effectiveness of ldr's seat, considering adjustability, cushioning, size, and back angle, rating scale 6 (1-6)

6058 Ldr sta, seat, adjustable vertically? (Yes/No; comments)

6060 Ldr sta, seat, stowable to facilitate standing during loading operations? (YES)

6062 Ldr sta, seat adjustable to provide platform for standing and outside viewing/firing ldr's weapon? (Yes/No; comments)

6064 Ldr sta, adequacy of seat configured to provide standing platform for open hatch viewing/weapons operation, rating scale 1 (1-6)

6066 Ldr sta, seat, material covering seat promote excessive sweating? (Yes/No; comments)

6068 Ldr sta, seat, material covering seat become excessively hot during operation in warm/hot climates? (Yes/No; comments)

6072 Ldr sta, seat, effectiveness of seat design/placement for seated loading/firing operations, rating scale 6 (1-6)

6074 Ldr sta, seat, distance from SRP to nearest main gun round stowed in ready rack, (mm; in.)

6076 Ldr sta, seat, distance from SRP to most distant main gun round stowed in ready rack, (mm; in.)

6077 Ldr sta, main gun ammo, projectile separate from propellent? (YES)

6078 Ldr sta, ease of access and loading of main gun ammo, rating scale 2 (4)

6090 Ldr sta, objects present preventing free interface with

main gun/access to main gun ammo?(NO)

6092 Ldr sta, main gun provided with stub case deflector? (NO)

6094 Ldr sta, main gun provided with stub case box? (NO)

6096 Ldr sta, distance from SRP to stub case box, (mm; in.)

6099 Ldr sta, main gun provided with stub/casing retractor tool/device? (Yes/No; comments)

6102 Ldr sta, probability of injury during loading/firing operations due to design of workstation, rating scale 5 (3)

6104 Ldr sta, probability of striking inadvertently the main gun round nose against bulkhead or objects within turret during loading process, rating scale 3 (3)

6110 Ldr sta, adequacy of workspace to perform rapid loading operations, rating scale 1 (4)

6112 Ldr sta, danger posed by sliding doors of main gun ammo bustle when accessing ammo, rating scale 5 (NO BUSTLE DOORS)

6114 Ldr sta, adequacy of workspace to allow a "safe area" to stand or sit to avoid injury from gun recoil, spent brass, etc, rating scale 1 (3)

6116 Ldr sta, ease of access to main gun ammo and operation of mechanisms to stow or release ammo, rating scale 2 (3)

6120 Ldr sta, average time to access main gun ammo, load, lock into breech, (no. trials; type ammo; seconds)

6122 Ldr sta, ease of uploading main gun ammunition from semi-ready rack to ready rack, rating scale 2 (4)

6126 Ldr sta, ease of main gun ammunition resupply through cmdr's hatch, rating scale 2 (4)

6128 Ldr sta, ease of main gun ammunition resupply through ldr's hatch, rating scale 2 (5)

6130 Ldr sta, average time to resupply main gun ammunition through cmdr's hatch, full stowage, non-NBC clad, (no. trials; no. rds; min./seconds)

6132 Ldr sta, average time to resupply main gun ammunition through ldr's hatch, full stowage, NBC MOPP-4, (no. trials; no. rds; min./seconds)

6136 Ldr sta, ease of access to stowed main gun ammunition, rating scale 2 (4)

6138 Ldr sta, coax, ease of access to load, charge, clear jams as required, non-NBC clad, rating scale 2 (5)

6140 Ldr sta, coax, ease of access to load, charge, clear jams as required, NBC MOPP-4, rating scale 2 (4)

6142 Ldr sta, coax, average time to load, non-NBC clad, (no. trials; seconds)

6144 Ldr sta, coax, average time to load, NBC MOPP-4, (no. trials; seconds)

6450 Ldr sta, coax, ease of dismounting coax for maintenance, rating scale 2 (1-6)

6452 Ldr sta, coax, ease of installing coax, rating scale 2 (1-6)

6454 Ldr sta, ease of access and operation of all ldr's controls without being subjected to main gun recoil, rating scale 2 (4)

6460 Ldr sta, ease of loading secondary weapon (i.e., 7.62 MG, .50 Cal MG, etc.), rating scale 2 (1-6)

6462 Ldr sta, ease of installing secondary weapon (i.e., 7.62 MG, .50 Cal MG, etc.), rating scale 2 (1-6)

6464 Ldr sta, ease of dismounting secondary weapon (i.e., 7.62 MG, .50 Cal MG, etc.), rating scale 2 (1-6)

6468 Ldr sta, ease of mounting, loading, dismounting secondary weapon (i.e., 7.62 MG, .50 Cal MG, etc.) with arctic mittens/NBC gloves, rating scale 2 (1-6)

6470 Ldr sta, average time to mount secondary weapon from stowed position, (no. trials; seconds)

6472 Ldr sta, average time to load secondary weapon, (no. trials; seconds)

6474 Ldr sta, accuracy, secondary weapon, average scores, (no.trials; no. rds per trial; percent rds on target)

6478 Ldr sta, effectiveness of ldr's periscopic vision, rating scale 6 (4)

6480 Ldr sta, outside horizontal visibility, ldr's periscopic/vision block system, (APPROX 200 DEGREES)

6482 Ldr sta, outside visibility, blind spots (RIGHT SIDE, RIGHT

REAR OF VEH)

6484 Ldr sta, outside visibility, vertical viewing, (degrees from horizen)

6486 Ldr sta, means provided to clear periscopes/vision blocks of frost, dust, etc. without exiting vehicle? (NO)

6488 Ldr sta, step (other than seat) provided for ingress to and egress from station? (NO)

6490 Ldr sta, location of step for ingress/egress, (text)

6492 Ldr sta, dimensions of step for ingress/egress, l x w, (mm; in.)

6494 Ldr sta, adequacy of controls/displays for critical tasks, rating scale 1 (4)

6496 Ldr sta, accessibility of controls, rating scale 4 (4)

6498 Ldr sta, ease of operation of controls, rating scale 2 (4)

6510 Ldr sta, quality of visibility of controls/displays for day/night operations, rating scale 3 (4)

6512 Ldr sta, viewing distance from design eye to nearest display, (mm; in.)

6514 Ldr sta, viewing distance from design eye position to most distant display, (mm; in.)

6516 Ldr sta, viewing angle from design eye position to worse case primary display, (degrees)

6518 Ldr sta, display functions grouped together? (YES)

6520 Ldr sta, displays readable, closed hatch? (YES)

6522 Ldr sta, displays illuminated? (YES)

6524 Ldr sta, displays color-coded efficiently IAW MIL-STD-1472C? (YES)

6526 Ldr sta, display color, primary display, (BLACK ON WHITE)

6528 Ldr sta, display color, secondary display, (red, blue-green, etc.)

6534 Ldr sta, control provided with primary display for variable luminance? (NO)

6536 Ldr sta, range of luminance for primary display, (display

description; range in lx; ft-L)

6538 Ldr sta, control provided with secondary display for variable luminance? (NO)

6540 Ldr sta, range of luminance for secondary display, (display description; range in lx; ft-L)

6544 Ldr sta, indicator lights grouped together, close to ldr's line of sight? (YES; REMOTE IR SET)

6566 Ldr sta, indicator lights correctly color-coded IAW MIL-STD-1472C? (YES)

6568 Ldr sta, indicator lights testable? (NO)

6570 Ldr sta, indicator lights dimmable? (NO)

6574 Ldr sta, range of luminance for indicator lights, (indicator light discription; range in lx; ft-L)

6576 Ldr sta, direction of control movement for all controls IAW MIL-STD-1472C? (YES)

6578 Ldr sta, for instrument panels, indicators, displays/controls, nomenclature used of appropriate size, contrast with background, and readable? (YES)

6580 Ldr sta, decals/placards readable, understandable, properly located? (YES)

6584 Ldr sta, overall ease of control actuation for all ldr's controls, rating scale 2 (4)

6586 Ldr sta, force required, worse case, ldr control actuation, (N; lbs)

6588 Ldr sta, protective covers/guards placed over controls or switches where appropriate? (NO; BOIL VESSEL SWITCH LACKING COVERS)

6590 Ldr sta, NBC collective protection provided? (YES; OVERPRESSURE)

6592 Ldr sta, if NBC collective protection not provided, describe system, (text)

6594 Ldr sta, NBC collective protection, location of interface point with which to hook into hose of individual vest/NBC suit (LEFT TURRET WALL OPPOSITE GUN BREECH)

6596 Ldr sta, NBC collective protection, air temp/humidity at mask, full cooling (ambient outside temp/humidity; temp/humid measured at mask, degrees C, degrees, F; Rh)

6598 Ldr sta, NBC, type of mask, (text)

6600 Ldr sta, NBC collective protection, air flow rate/volume at mask (ft/min; cu ft/min)

6640 Ldr sta, general adequacy of NBC collective protection, (mask and vest, bulk dump, etc.), rating scale 1 (1-6)

6642 Ldr sta, NBC collective protection, effectiveness of overpressure, rating scale 6 (1-6)

6644 Ldr sta, NBC effectiveness of NBC system to strain dust, other non-NBC particulates from outside, rating scale 6 (1-6)

6646 Ldr sta, hatch provided? (YES)

6648 Ldr sta, hatch, ease of opening/closing from inside vehicle, rating scale 2 (3)

6649 Ldr sta, hatch, ease of unlocking/opening from outside, rating scale 2 (4)

6650 Ldr sta, time to egress, from closed hatch position to outside of vehicle, non-NBC clad, (seconds)

6651 Ldr sta, hatch, locking mechanism vulnerable to damage by enemy fire? (NO)

6654 Ldr sta, time to egress, from closed hatch position to outside of vehicle, NBC MOPP-4, (seconds)

6656 Ldr sta, adequacy of hatch in size for 95th percentile arctic garbed male, rating scale 1 (5)

6658 Ldr sta, hatch dimensions, l x w x d, (20 X 17 IN.)

6660 Ldr sta, hatch, combat lock provided? (YES)

6662 Ldr sta, force required to unlock combat lock, (N; lbs)

6664 Ldr sta, adequacy of hatch entry padding, rating scale 1 (2)

6666 Ldr sta, ease of releasing hatch from secured, open hatch position, to closed hatch position, rating scale 2 (3)

6668 Ldr sta, force required to release lock-back latch mechanism, (N; lbs)

6670 Ldr sta, average time to emergency egress ldr sta, from closed hatch position, non-NBC, (no. trials; seconds)

6672 Ldr sta, average time to emergency egress ldr sta, from closed hatch position, NBC MOP-4, (no. trials; seconds)

6674 Ldr sta, effectiveness of ldr's unity periscope/vision blocks for surveillance, w/o NBC mask, rating scale 6 (1-6)

6676 Ldr sta, effectiveness of ldr's unity periscope/vision blocks for surveillance, w/NBC mask, rating scale 6 (1-6)

6680 Ldr sta, location of communications equipment, (TURRET WALL, BEHIND LEFT SHOULDER; RADIO IN TURRET BUSTLE DIRECTLY BEHIND LDR)

6682 Ldr sta, ease of operation of com box w/arctic handwear, rating scale 2 (1-6)

6684 Ldr sta, speech intelligibility, ldr com equip, CVC helmet, non-NBC, MRT, (percent correct)

6686 Ldr sta, speech intelligibility, ldr com equip, CVC helmet, w/NBC mask, MRT, (percent correct)

6688 Ldr sta, com equip, space between connector and bulkhead or nearest object, (ZERO CLEARANCE)

6690 Ldr sta, quality of speech intelligibility, CVC helmet, non-NBC, rating scale 2 (1-6)

6692 Ldr sta, quality of speech intelligibility, CVC helmet, w/NBC mask, rating scale 2 (1-6)

6700 Ldr sta, chance of handedness or eye glasses interfering with operations, rating scale 3 (3)

6702 Ldr sta, general adequacy of interior lighting, rating scale 1 (1-6)

6704 Ldr sta, accessibility of controls for interior lighting, rating scale 4 (5)

6706 Ldr sta, safeguard provided against inadvertent activation of interior lights? (Yes/No; comments)

6708 Ldr sta, heater, temperature at ldr's station, (degrees C: degrees, F)

6710 Ldr sta, heater, station designed for equal distribution of heat? (Yes/No; comments)

6714 Ldr sta, ventilation, non-NBC; effectiveness of fresh outside air ventilation system, rating scale 6 (1-6)

6716 Ldr sta, ventilation, non-NBC; air flow rate/volume at station, (ft/min; cu ft/min)

6718 Ldr sta, ventilation, non-NBC; proportion fresh outside air provided to station, (percent)

6720 Ldr sta, ventilation, non-NBC; variable control provided for ventilation? (Yes/No; comments)

6722 Ldr sta, ventilation, non-NBC; accessibility to ventilation control, 4 (1-6)

6728 Ldr sta, steady-state noise hazards, any frequency/condition, rating scale 5 (1-6)

6730 Ldr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 125 HZ, (dBA)

6734 Ldr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 500 HZ, (dBA)

6738 Ldr sta, steady-state noise, closed hatch, veh moving, 30 MPH, hard surfaced road, 2000 HZ, (dBA)

6740 Ldr sta, impulse noise hazards, main gun/coax, rating scale 5 (1-6)

6742 Ldr sta, impulse noise, main gun firing, closed hatch, gun pos forward, (A duration; B duration; peak pressure-dBA)

6750 Ldr sta, seat vibration, prob of degrading task performance, rating scale 7 (1-6)

6752 Ldr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, X-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

6754 Ldr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Y-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

6756 Ldr sta, whole body vibration, at SRP IAW TECOM TOP 1-2-610, Z-axis, (RMS, 30 HZ; RMS, 50 HZ; RMS, 80 HZ)

6758 Ldr sta, general anthropometric fit, [percentile male]

Human Factors Engineering Data Base
File Name: AMR6
Crew Integration, Safety, Health Hazards

7000 CVC helmet, effectiveness to protect against injury, rating scale 6 (1-6)

7002 CVC helmet, effectiveness of helmet communications device, rating scale 6 (1-6)

7006 Crew, feasible to cross-train crewmembers in all functions of the vehicle? (YES; MOST TASKS APPEAR TO INVOLVE SIMPLE OPERATIONS)

7008 Crew, description of cross-training, (text)

7010 Crew, effectiveness of operation of vehicle in degraded mode, 3 man crew, rating scale 6 (4)

7012 Crew, effectiveness of operation of vehicle in degraded mode, 2 man crew, rating scale 6 (4)

7014 Crew, approximate overall degradation with reduced, 3 man crew, (70 PERCENT?)

7016 Crew, approximate overall degradatien with reduced, 2 man crew, (40 PERCENT?)

7020 Crew, workload, probability of workload breakdown during combat operations, rating scale 7 (4)

7022 Crew, driver workload, simulated combat, (numerical score on SWAT)

7024 Crew, cmdr workload, simulated combat, battle management, (numerical score on SWAT)

7026 Crew, gnr workload, simulated combat, (numerical score on SWAT)

7028 Crew, ldr workload, simulated combat, (numerical score on SWAT)

7040 NBC/Arctic gear, considering design of vehicle, probability of NBC/arctic gear degrading crew performance of critical tasks, rating scale 7 (4)

7042 NBC/Arctic gear, probability of NBC/arctic gear interfering with emergency egress from vehicle, rating scale 7 (3)

7044 NBC/Arctic gear, probability of NBC/arctic gear interfering with emergency egress, rating scale 7 (3)

7046 NBC/Arctic gear, adequacy of workspace to permit efficient donning/doffing of NBC/arctic garb, rating scale 1 (1-6)

7048 NBC decontamination, effectiveness of procedures, rating scale 6 (1-6)

7050 NBC decontamination, type of decontamination agent in use, (text)

7052 NBC decontamination, probability of damaging exposed, sensitive instruments/equipment w/decon agent, rating scale 7 (1-6)

7056 Water stowage, capacity, (liters; gals)

7058 Water stowage, accessibility to stowed water, rating scale 4 (1-6)

7064 Water stowage, effectiveness of stowage to avoid interference with crew activities, rating scale 6 (1-6)

7066 Water stowage, accessibility to each crewmember, rating scale 4 (1-6)

7068 Water stowage, ease of refilling water stowage container, rating scale 2 (1-6)

7070 Water stowage, time to refill water stowage container, (seconds)

7072 Water stowage, probability of damage to stowage container from vehicle motion, crew handling, etc., rating scale 7 (1-6)

7074 Water stowage, adequacy of insulation of water supply against extreme heat/cold, rating scale 1 (1-6)

7076 Ventilation, location of fresh air intake, distance from engine/other exhausts, (text; mm; in.)

7078 General, adequacy of interior space for extended ops; crew work/rest cycles, rating scale 1 (1-6)

7080 General, probability of crew injury from turret traversal, elevation/depression of main weapon, rating scale 7 (5)

7082 General, adequacy of padding of protruding objects to protect crew from injury, rating scale 1 (4)

7090 Toxic fumes, probability of task degradation because of CO, NH3, NO2, or SO2 concentrations, rating scale 7 (1-6)

7092 Toxic fumes, health hazards imposed on crew, rating scale 5 (1-6)

7094 Toxic fumes, level of CO, turret, automotive, closed hatch, (PPM; COhB)

7096 Toxic fumes, level of CO, turret, main gun firing, closed hatch, 6 rnds, (PPM: COhB)

7098 Toxic fumes, level of CO, turret, main gun firing, closed hatch 10 rnds, (PPM; COhB)

7100 Toxic fumes, level of SO2, turret, main gun firing, closed hatch, 6 rnds, (PPM)

7102 Toxic fumes, level of SO2, turret, main gun firing, closed hatch, 10 rnds, (PPM)

7104 Toxic fumes, level of NO2, turret, main gun firing, closed hatch, 6 rnds, (PPM)

7106 Toxic fumes, level of NO2, turret, main gun firing, closed hatch, 10 rnds, (PPM)

7108 Toxic fumes, level of NH3, turret, main gun firing, closed hatch, 6 rnds, (PPM)

7110 Toxic fumes, level of NH3, turret, main gun firing, closed hatch, 10 rnds, (PPM)

7112 Ventilation, bore evacuator provided? (YES)

7114 Ventilation, ventilator fan in turret provided? (Yes/No; comments)

7116 Ventilation, emergency ventilation system provided? (Yes/No; description/comments)

7120 Fire suppression, automatic fire suppression system provided? (YES)

7122 Fire suppression, overall adequacy of system, rating scale 1 (1-6)

7124 Fire suppression system, automatic activation time (miliseconds)

7126 Fire suppression, accessibility to system for repair, manual activation, rating scale 4 (5)

7128 Fire suppression, probability of inadvertent activation, rating scale 7 (3)

7130 Fire suppression, portable fire extinguisher provided? (YES)

7132 Fire suppression, quick accessibility to fire extinguishers, rating scale 4 (4)

7140 Maintenance, automotive, accessibility to drain valves, rating scale 4 (1-6)

7142 Maintenance, automotive, accessibility to oil filters, rating scale 4 (1-6)

7144 Maintenance, automotive, accessibility to air filters, rating scale 4 (1-6)

7146 Maintenance, automotive, accessibility to engine adjustments, rating scale 4 (1-6)

7148 Maintenance, automotive, accessibility to batteries/terminals, rating scale 4 (1-6)

7150 Maintenance, interior, accessibility to weapons, rating scale 4 (5)

7152 Maintenance, interior, accessibility to hydraulics, rating scale 4 (1-6)

7154 Maintenance, interior, accessibility to electrical systems, rating scale 4 (1-6)

7156 Maintenance, ease of identifying PMCS checkpoints, rating scale 2 (1-6)

7158 Maintenance, general adequacy of workspace for performing checks, maintenance services, rating scale 1 (4)

7160 Maintenance, ease of reading dipsticks, gauge levels, etc, rating scale 2 (1-6)

7166 Maintenance, automotive, average time to perform routine maintenance checks, (no. trials; min/sec)

7168 Maintenance, automotive, average time to replace oil filter, (no. trials; min/sec)

7170 Maintenance, automotive, average time to replace air filter, (no. trials; min/sec)

7172 Maintenance, effectiveness of caution/warning labels/placards for PMCS considering size, location, color-coding, etc., rating scale 6 (1-6)

7174 Maintenance, special tools required (Yes/No; comments)

7178 Maintenance, special tools stowed on-board vehicle? (Yes/No; comments)

7180 Maintenance, adequacy of maintenance procedures in terms of complexity, training requirements, etc., rating scale 1 (1-6)

7182 Maintenance, specialized diagnostics required? (Yes/No; comments)

7184 Maintenance, built-in test/diagnostic equipment provided? (Yes/No; comments)

7186 Maintenance, average time to diagnose faults, (no. trials; seconds)

7188 Repairs, interior, accessibility to electrical cables/hydraulic lines, rating scale 4 (4)

7190 Repairs, quality of protection afforded to cables, indicators, etc. against inadvertent damage during repairs, rating scale 3 (4)

7192 Repairs, cables/indicators, etc., adequacy of labels, color-coding, etc. for easy identification, rating scale 1 (4)

7194 Repairs, emergency; is system designed to "short track" in event of emergency?(Yes/No; comments)

7196 Stowage, adequacy of design for stowage of replacement items (i.e., road wheels, track blocks, firing pins, etc.) for transport into combat, rating scale 1 (4)

7198 Battle damage assessment/repair, capability/probability of crew being able to assess/repair damage during combat, rating scale 7 (1-6)

7206 Maintenance, ease of removing/replacing power pack, rating scale 2 (1-6)

7208 Maintenance, ease of breaking track (consider workspace and linkage assemblies), rating scale 2 (1-6)

7210 Maintenance, average time to break track, replace new linkage, (no. trials; min/sec)

7214 Refueling, ease of accessing fuel inlet, manipulating with arctic handwear, rating scale 2 (5)

7218 Stowage, adequacy of space for personnel equipment, NBC garments, individual weapons/ammunition, inside vehicle, rating scale 1 (4)

7220 Stowage, personnel gear/weapons stowed outside vehicle? (YES; DOCUMENTS INDICATE NBC SUITS STOWED OUTSIDE WITH OTHER PERSONAL ITEMS)

7222 Stowage, adequacy of stowage of combat rations, rating scale 1 (4)

7224 Stowage, amount of personnel combat rations stowed on-board, (days)

7226 Stowage, quick access of personnel weapons/ammunition/ grenades, rating scale 4 (1-6)

7228 Stowage, accessibility of main gun ammumition, uploading, rating scale 4 (4)

7230 Stowage, accessibility of coax/cmdr's weapon ammunition, rating scale 4 (1-6)

7232 Stowage, adequacy of design to protect against inadvertent ignition/explosion of main gun rnds, rating scale 1 (3)

7234 Stowage, adequacy of design to protect against inadvertent ignition/explosion of coax/other ammunition, rating scale 1 (4)

7236 Stowage, method of uploading vehicle, through turret, other means, (THROUGH LDR'S HATCH)

7238 Stowage, ease of uploading/downloading, main gun ammunition, consider hatches, hull obstructions, etc., rating scale 2 (4)

7240 Stowage, average time to upload, main gun rnds, (no. trials; min/sec)

7242 Stowage, average time to upload, coax, other ammunition, water, rations, (no. trials; min/sec)

7244 Stowage, relative difficulty uploading main gun rnds, NBC MOPP-4/collective protection system, rating scale 2 (1-6)

7246 NBC, type of individual ensembles (text)

7250 Combat operations, pre-combat systems checks required?(Yes/No; comments)

7252 Combat operations, average time to conduct pre-combat systems checks, (no. trials; min;sec)

7254 Combat operations, ease of boresighting/zeoring main gun, rating scale 2 (1-6)

7256 Combat operations, average time to boresight/zero main gun, (no. trials; min;sec)

7258 Combat operations, effectiveness of procedures for rapid,

logical sequence of firing commands, rating scale 6 (1-6)

7566 Combat operations, multiple concurrent tasks required during target acquisition, tracking, firing, reloading main weapon? (Yes/No; comments)

7568 Combat operations, probability of system exceeding physical and/or mental capabilities of crew during combat, rating scale 7 (4)

7570 Combat operations, probability of vibrations/accelerations causing adverse effects on vehicle, rating scale 7 (1-6)

7576 Combat operations, effectiveness of battle management operating within platoons, rating scale 6 (1-6)

7578 Training, system design accommodating to training aids, instructional devices, NET?(Yes/No; comments)

7586 Extended operations, method provided for waste elimination? (Yes/No; comments)

7590 NBC System, method provided for intake of water/food without removing NBC mask? (Yes/No; comments)

7594 Smoke grenades, ease of reloading, rating scale 2 (5)

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Report identifies data elements of a generic nature for an armored vehicle (main battle tank), which cover critical human factors engineering interests and parameters regarding the tank. Report also sets out a methodology for collecting or obtaining the identified data elements. In Volume II, III, and IV are respectively reported collected human factors data elements for three tanks, as follows: British Centurion, British Chieftain, and French AMX 13.

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